# THE HEATING AND VENTILATING MAGAZINE

Vol. XIII. No. 1.
$1.00 a year. 10 cents a copy.

NEW YORK, JANUARY, 1916.

Publication Office:
1123 Broadway, New York



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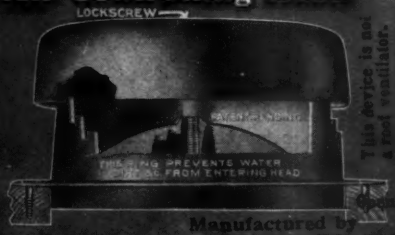


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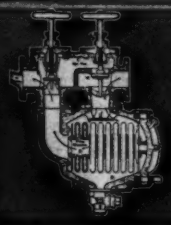

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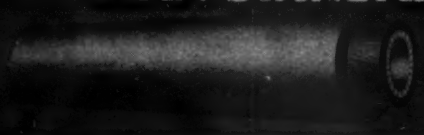

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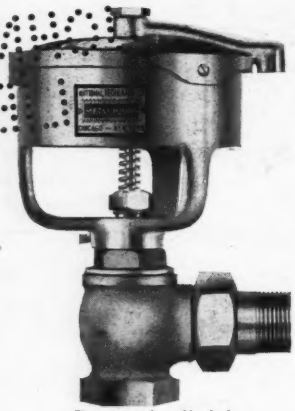

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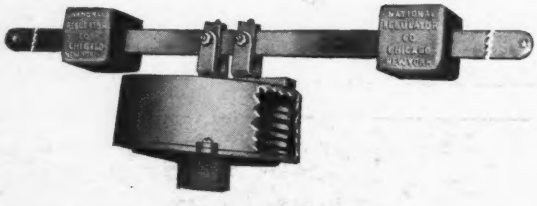

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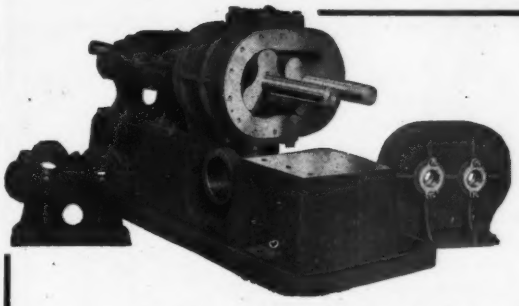

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This high grade Pump has been used for Vacuum Heating since 1908 in modern hotel, office, store, factory and other buildings in every state and city.

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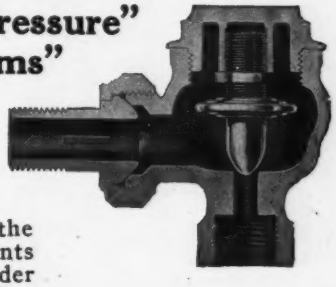
**For Radiators and Coils of "Low Pressure" "Vapor" and "Vacuum Heating Systems"**

**Freely Discharges Air and Water WITHOUT LOSS OF STEAM**



THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor and vacuum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, **to free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

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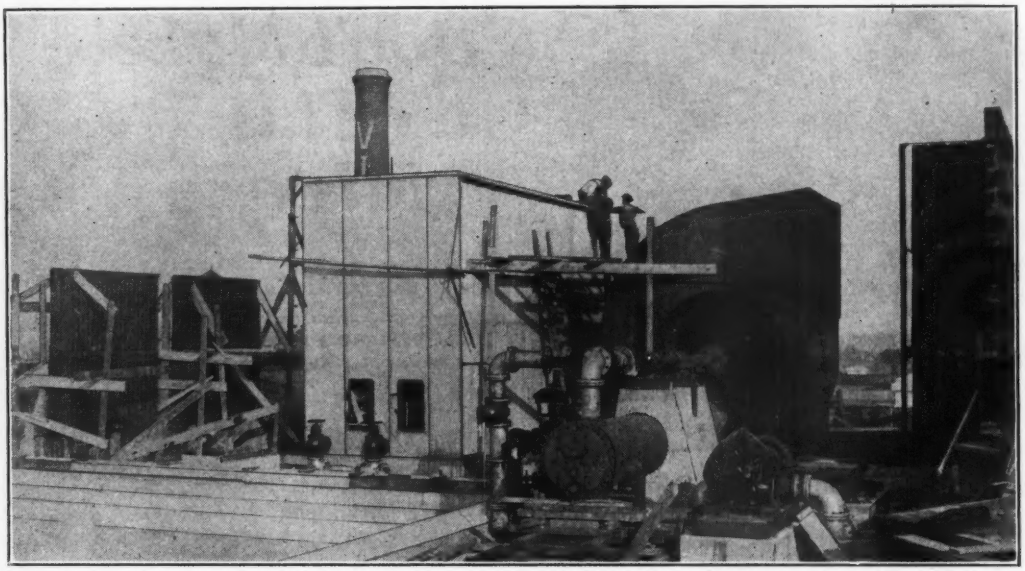

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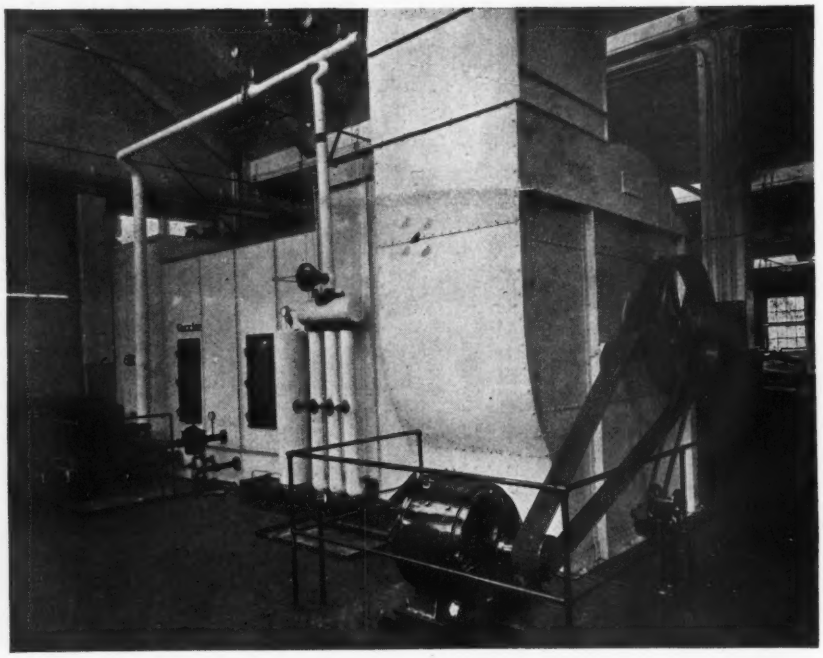

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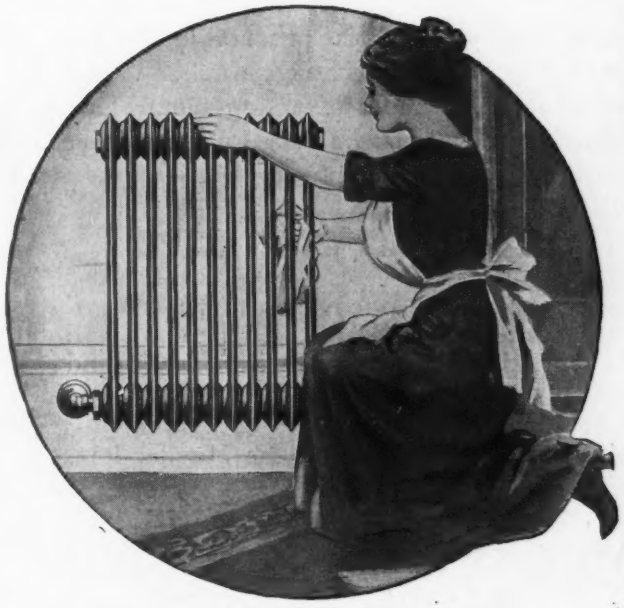

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**It makes no difference what pressure you want to control—steam, air, oil, water, gas, acetylene or oxygen, etc.,—there's a Mueller valve that will meet the requirements.**

Our line is complete. It covers every phase of pressure reduction and regulation. Large and small plants of every kind are using Mueller Valves and they speak only praise for them.

We shall be glad to send you our catalog giving complete information in regard to the Mueller line.

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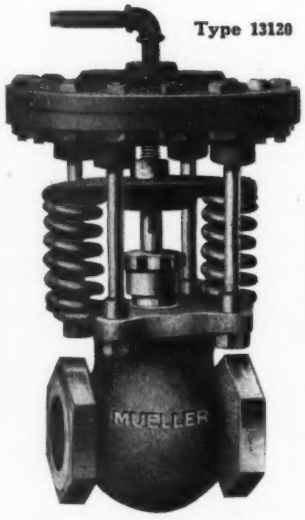


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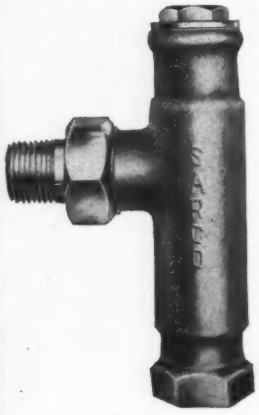
**Principle—Thermostatic**
**Motive Power—Liquid Expansion and Contraction**



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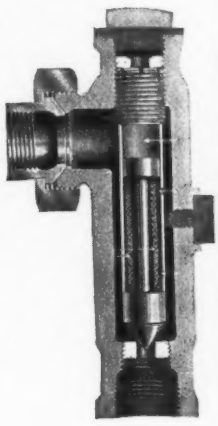

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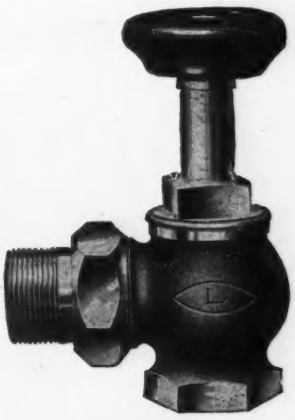
# Right Principles



No man, no machine, nor product, can give satisfaction unless he or it works on right principles—The man who is right, knows, and tells about it, is bound to have the support of every man who comes within his range—It takes time to prove whether a man is right or not, just as it takes actual demonstration to testify to the value of an article like a radiator valve.

For nine years we have been proving that

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are right in principle and thousands of successful heating jobs attest this efficiency every day. This valve is a Pioneer—developed when the need came for such an article and foremost at the present time—The principle is right.

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**For Safety, Sureness of Operation and Durability**

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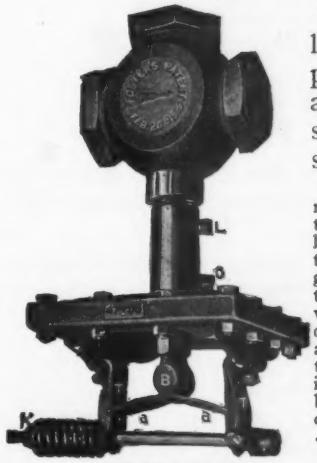
FOR STEAM HEATING SERVICE

**(Classes "Q" and "Q H")**



lead the way. Designed especially for steam heating, and suitable for vacuum systems, for delivery pressure of from 1 to 15 lbs.

We make several types of pressure regulators—those shown in the illustrations here were designed particularly for steam heating service, and they are very sensitive, reliable, high grade in every particular and superior to other makes in construction and workmanship. There are no weights or close fitting pistons, and are easily adjusted to the desired pressure between 1 and 15 lbs. Made in sizes ¾ inch to 2 inches inclusive, composition body. Larger sizes are fitted with composition renewable seats.

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These Valves are fully explained on Pages 29 to 33 of our 1913 Catalogue, No. 20. Please mail copy of Catalogue to

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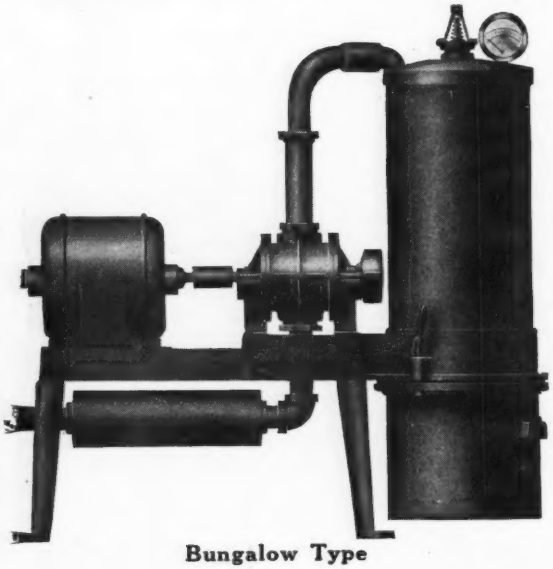
# "The Connersville System" Vacuum Cleaner



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A few reasons WHY you should buy "The Connersville."

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It is a CLEANER that CLEANS.

**BECAUSE**
It renovates everything in the building from cellar to garret.

**BECAUSE**
It is Sanitary, no dirt or dust is blown into the open air to jeopardize the health of your neighbors.

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It is the simplest, most durable and economical.

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**Show us ONE instance where the Kernchen Siphonage Ventilator has been torn down and replaced by any other kind.**

**Other ventilators are being rapidly torn down and replaced by the Kernchen Siphonage, for**

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## Kernchen Company, Ventilating Engineers

**GENERAL OFFICES, 1637 McCORMICK BUILDING, CHICAGO, ILL.**
**New York Office, 1267 Broadway**

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VOL. XIII. No. 1

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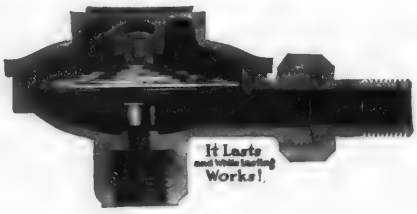
# THE DUNHAM RADIATOR TRAP




## and DUNHAM SYSTEMS of HEATING are *CONSIDERED STANDARD*

"DUNHAM or equal" are the words found in the heating specifications of practically every large architect and engineer in the United States and Canada. This is perfectly natural when it is remembered that it was the Dunham trap that commercialized the hollow disc thermostatic principle in radiator trap construction.

Our complete bulletin catalog H11 describes the Dunham line. Copy free upon request.

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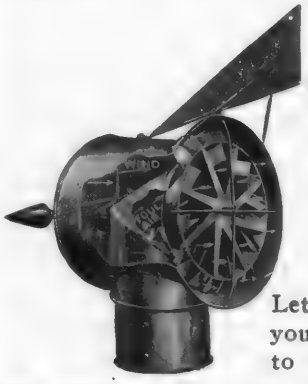


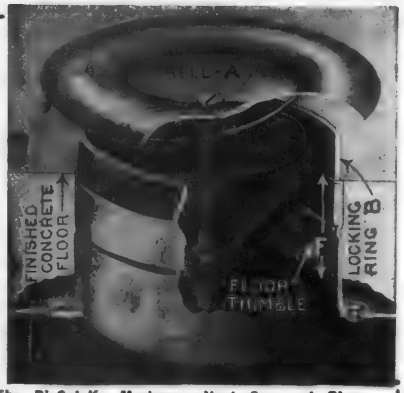
## Ventilators Fan Suction

## Power Bills?

Let the air that passes over your building furnish the power to ventilate it.

The **BICALKY** does this regardless of weather conditions or temperature. **WE GUARANTEE RESULTS. WRITE FOR INFORMATION.**

**BICALKY FAN CO. Buffalo, N. Y.**




**The Bi-Cal-Ky Mushroom Vent Cap and Floor Thimble Used in Floors with Fan System in Theatres, Schools, Churches and Public Buildings** is far superior to any other cap and thimble on the market in simplicity, appearance and efficiency, as well as low in price.

The BI-CAL-KY cap acts as a combination damper and diffuser and the screw as a support, adjusting rod and lock for the cap. The cap is raised or lowered by simply turning the screw. This increases or decreases the opening through which the air escapes, thereby insuring an equal distribution of air at the periphery of the cap.

Note projection of cap which deflects the air towards the floor, thereby eliminating draughts. Compare with other caps.

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK JANUARY, 1916

BURLEY HIGH SCHOOL, BURLEY, IDAHO.

## *Electric Heating for a Large High School*

DETAILS OF THE NOTABLE PLANT INSTALLED AT BURLEY, IDAHO.

In THE HEATING AND VENTILATING MAGAZINE for May, 1914, a description was published of the Rupert "electric" high school, at Rupert, Idaho, in which electricity is used throughout as the heating medium. The electric current for this building comes from the Government power house at Minidoka Dam, 14 miles above Rupert on the Snake River. It is distributed by the Rupert Electric Company and sold at $1.00 per kilowatt per month.

Another school building located on the Minidoka Project, one of the United States Reclamation Service Projects, is the high school at Burley, Idaho, and this building has now been equipped with a similar type of electric-heating plant. It is a larger proposition than the Rupert plant and, indeed, is said to be the largest plant of its kind in the world.

The high school was built during the past summer and was completed for occupany, September 14, 1915. The building is of concrete, with an overall length of 165 ft. and a depth of 127 ft. It is three stories high, with nothing below the ground level except the gymnasium and the heating plant rooms. The building was planned by C. Lewis Wilson & Co., of Butte, Mont., working with J. J. Rae, superintendent of schools at Burley.

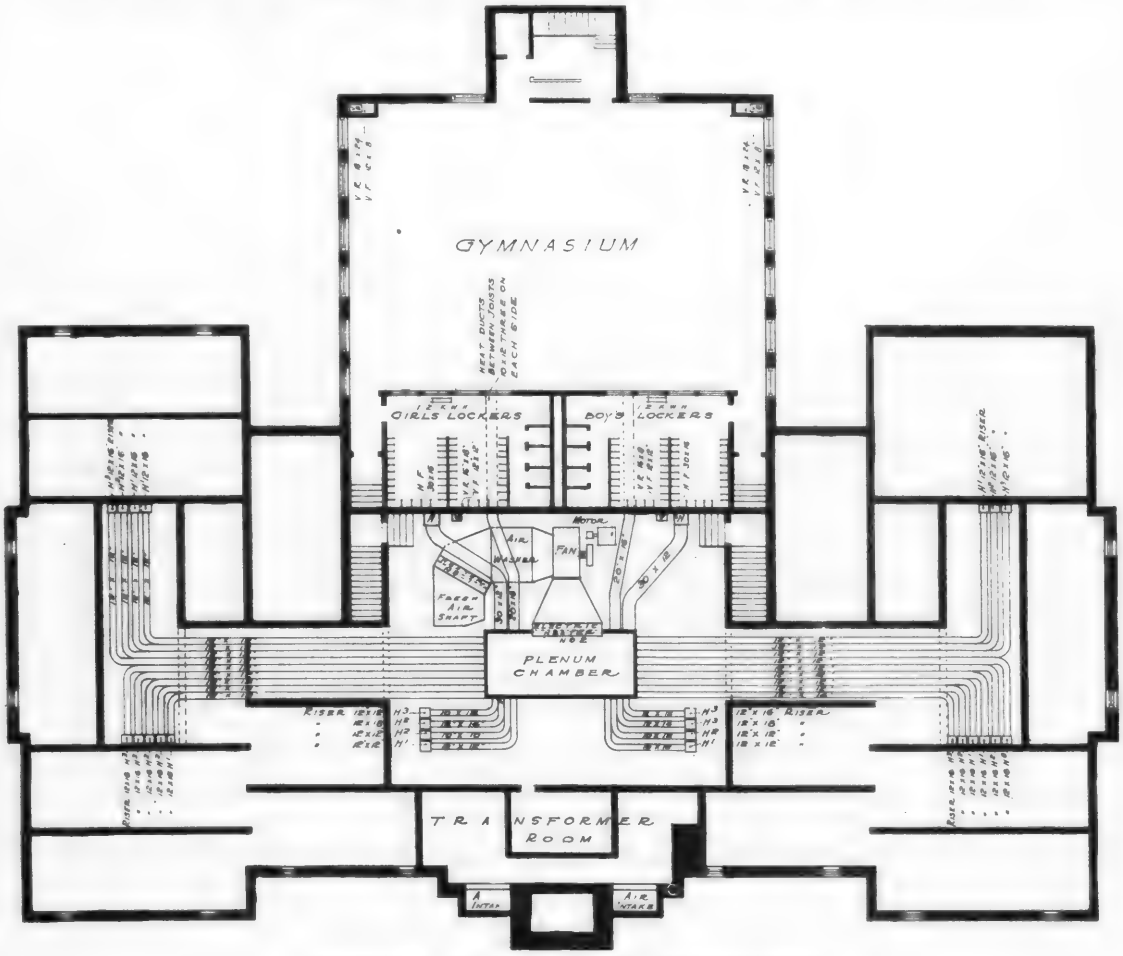
### ELECTRIC HEATING SYSTEM CHOSEN AFTER INSPECTION OF RUPERT PLANT.

The board of trustees chose the electric heating system after investigating the electric heating plant at Rupert, Idaho, which is within nine miles of Burley. The

Burley building, however, encloses about twice as much cubical space, necessitating a considerable modification of the layout. At the present writing (December 1, 1915) the Burley plant appears to be a success in every way.

The Minidoka Dam, where the energy for the building is generated, is 22 miles from Burley, on the Snake River. The 2/0 steel-taped feeders, 2200 volts. In the transformer room the voltage is reducted to 440 volts for heating at full capacity and to 220 volts for times when not so much heat is being used and when the fan is not in motion.

This is accomplished by three 200 K.V.A., type H, 2200-volt primary, 440-220-volt secondary, 60-cycle transformers




BASEMENT PLAN, BURLEY HIGH SCHOOL.

government contract is with the city of Burley and the school has a contract with the city. According to this contract, electricity is furnished at a cost of $1.00 per kilowatt per month, corresponding to the cost at the Rupert school. This, it is stated, is probably the cheapest rate for electricity on record at the present time.

The energy is carried from the dam to the city on high tension, 33,000-volt, three-phase transmission lines. It enters the building underground by three-phase, of the General Electric Company's make. These are located in the concrete transformer room, in the front portion of the basement heating room. They are controlled from the superintendent's office by an automatic no-voltage and overload release switch, three-phase.

From the transformer room the energy is conveyed to the switch board by three 500,000 c.m. three-phase, steel-taped cables and here distributed to the different relays which feed the heating grids.

ARRANGEMENT OF HEATING GRIDS.

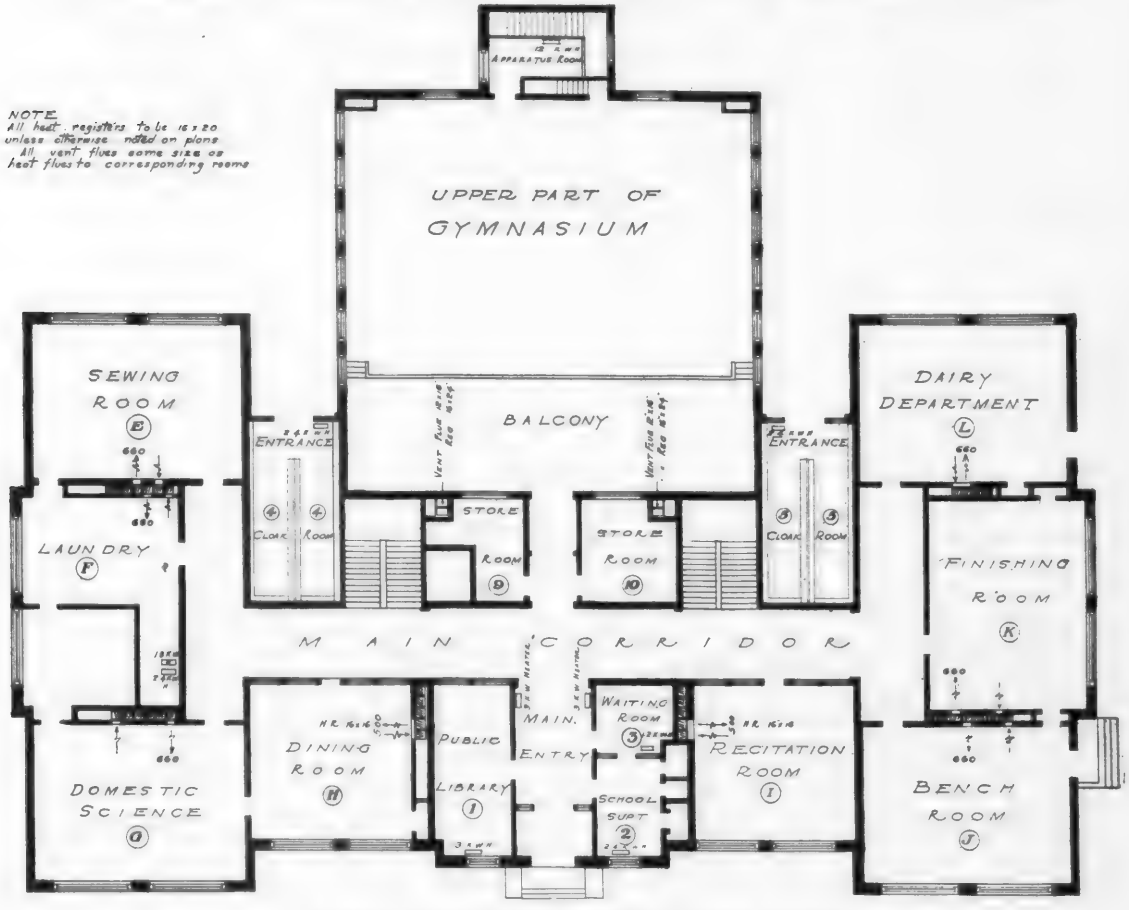
The grids are arranged in two batteries, the first battery being at the foot of the air shaft which supplies air from the roof level. This set heats the air to 60° F., before it strikes the air washer and humidifier. An automatic temperature control keeps the air at this temperature by throwing the grids on and off as changes in the outside temperature require. This makes the supply of heat absolutely automatic and no more energy is used than that necessary to supply the desired heat.

The water in the air washer is circulated by a motor and centrifugal pump. The spray plays over three sets of louvres. Beyond the washer is located the fan and beyond that is the plenum chamber which is divided into an upper and lower compartment. At the fan side of the upper compartment is the second battery of grids. The air in this compartment is kept at the desired temperature by an automatic control which throws the energy on and off the grids, as the temperature requires.

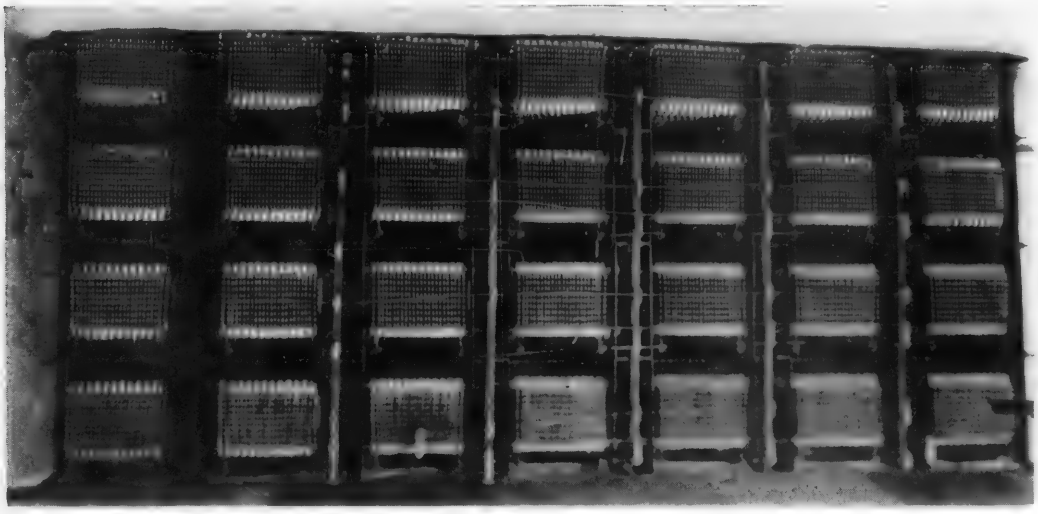
HOW THE HEAT IS CONTROLLED IN EACH ROOM.

The heat is controlled in each room by thermostats operating dampers at the plenum chamber openings. Air is taken from the lower compartment of the plenum chamber, when the room is too warm, and from the upper chamber, when the opposite condition prevails. The system of control was installed by the Johnson Service Company.

Air is supplied to the building from the roof level and through the operation of the equipment mentioned, is washed and humidified and sent into the rooms at a temperature which is controlled automatically. An overheated room is not cooled by introducing more cold air and thus



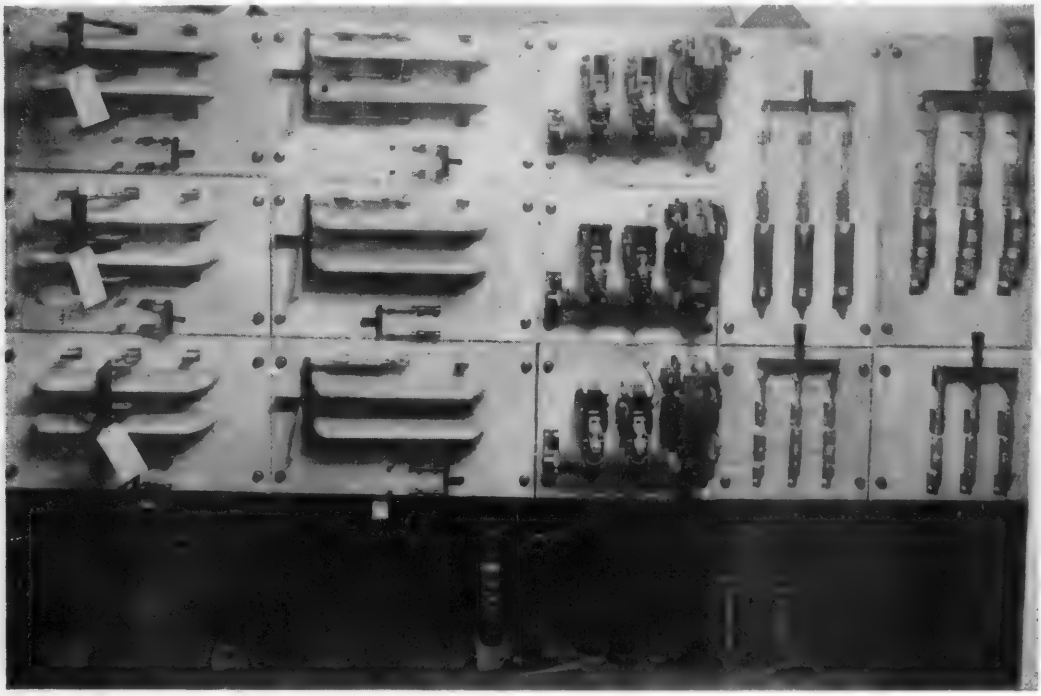

FIRST FLOOR PLAN, BURLEY HIGH SCHOOL.



BATTERY OF ELECTRIC HEATING GRIDS IN PLENUM CHAMBER, BURLEY HIGH SCHOOL.

dissipating the over-supply of heat, but the energy is cut off before the over-supply is produced.

At the present writing the system is proving very satisfactory and the amount of energy being used is costing $187 per month. This makes the heating comparatively more expensive than if coal were used, but several factors enter into the problem to alter conclusions as to total cost. The first is the matter of space. The electric heating plant occupies a comparatively small space in the basement. Another form of heating would require an extra building and smoke stack.



SECTION OF SWITCHBOARD FOR ELECTRIC HEATING PLANT IN BURLEY HIGH SCHOOL.

The life of the equipment here used will be five to eight times the life of a steam plant. Again, the labor required to operate this plant is almost negligible and this makes a large saving. The absence of coal in the building is, of course, an especially desirable feature of the plant. The smoke from the coal plant is something that can well be missed. Still another point is that the heat is always ready. During the four years that the Government has been generating electrical energy at the Minidoka Dam, the service has not been cut off fifteen minutes at a time.

The Utah Engineering and Machinery Co., Salt Lake City, was the successful bidder on this work and the design was furnished by the company's chief engineer, N. L. Alison, with the assistance of H. T. Plumb, district engineer for the General Electric Co. F. E. Ware, city electrician of Burley, designed the transformer installation and all equipment pertaining to the primary side.

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## *Some Elements of Smokeless Furnace Design*

By Osborn Monnett. *

*Presented at the November,* 1915, *meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers.*

It is the purpose of this paper to call attention to the characteristics of a few conventional settings which have been used in the past, and to point out ways in which they may be improved from a smoke standpoint for territories using high volatile, long flaming coal.

### HIGH PRESSURE POWER BOILERS.

With the many types and shapes of boilers on the market today boiler practice gives opportunity for innumerable combinations of stokers and furnaces. The type selected, either of boiler or furnace, does not have as much bearing on the smoke performance as does the manner in which the combination is put together. It is sometimes quite a problem to get a boiler and furance connected in such a manner that both will have a chance to give the best results.

*Chain Grate.*—Plate 1, Fig. A shows in outline an old type, chain-grate setting with a 3½-ft. ignition arch, the stoker being set under the boiler with a clearance of 6 ft. from floor to front header. This setting is typical of the older practice in chain-grate setting, with low, short, flat arch, poor ignition and low capacity. Such an outfit cannot be considered smokeless when carrying any considerable load. The deadening effect of the bank of tubes is such as to extinguish the flame before combustion has become complete, in the same manner that a wire netting will kill the flame from a gas burner, the result being a great deal of smoke. While this setting gives very short flame travel, it must not be inferred that mere length of flame travel is always enough to insure a satisfactory setting. It has been found that on a long gas pass, unless some positive means are taken to cause a mixture, the gases frequently become stratified and do not mix, in which case the combustion cannot be complete.

In Fig. B, Plate 1, the boiler has been raised to 10 ft. under the header; the ignition arch lengthened to 5 ft. and set full extension. This allows more flame travel, but the setting still has some of the defects of the first one and is not good for high capacities. One of the principal defects is that the flow of rich volatile matter may pass into the bank of tubes in an uninterrupted current in the front part of the furnace, while most of the oxygen necessary to burn this volatile matter is passing in at the back part. There is a lack of mixture and consequently incomplete combustion and low economy.

Fig. C, Plate 1, corrects the above defects by using a longer arch, setting the stoker farther under the boiler, decreasing the floor space occupied and narrow-

*Mechanical Engineer, American Radiator Co.; formerly chief smoke inspector of Chicago.

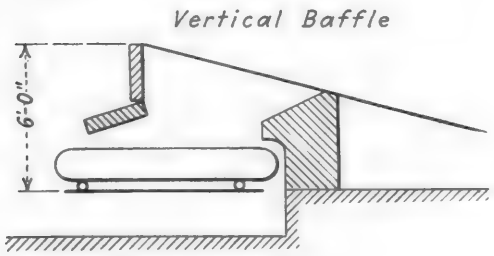


FIG. A Poor

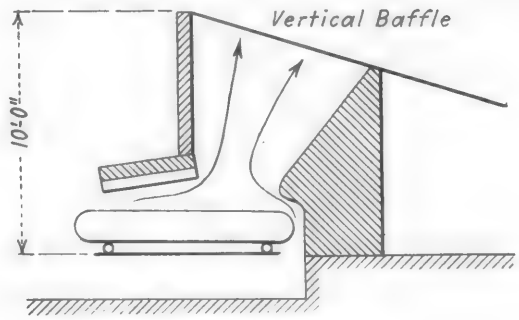


FIG. B Poor

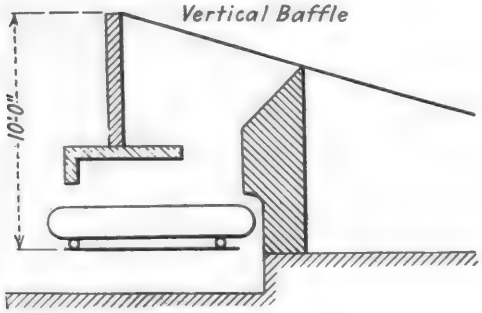


FIG. C Good

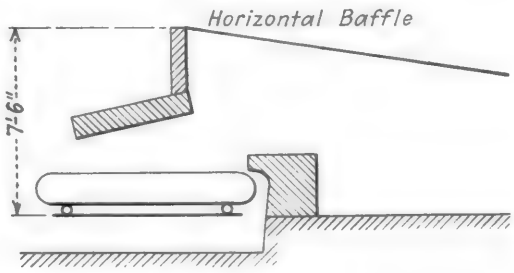


FIG. D Good

PLATE 1—SOME CHARACTERISTICS OF CHAIN GRATE SETTINGS.

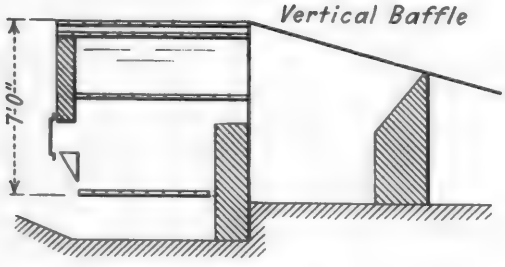


FIG. A Poor

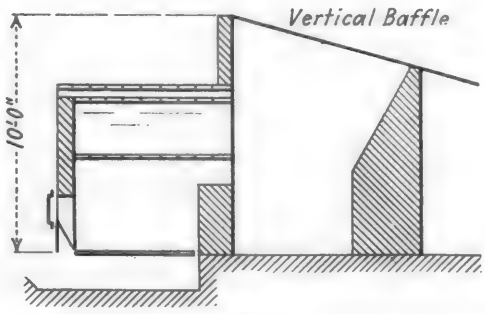


FIG. B Better

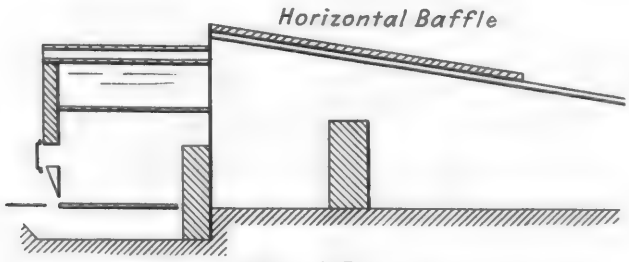


FIG. C Best

PLATE 2—DOUBLE-INCLINED STOKERS AND HORIZONTAL WATER-TUBE BOILERS.

ing up the furnace throat opening so that the volatile gases and air mix in a high temperature zone, which easily completes combustion on a 10 ft. setting. Experiments have been made to determine the best throat opening for commercial use. Openings from 18 in. to 36 in. have been tried with success, the smaller ones being high in maintenance; 30 in. is about the most satisfactory opening for all around use.

Another factor, which has had a marked effect on the performance of the later chain-grate settings, has been the height of the ignition arch at the gate; where 11 in. was formerly the standard height for a flat arch, it has now been increased to 15 in., and the slope of the arch has been increased to 2 in. or 3 in. per ft. Where the arch is sprung across the furnace, it is now set level, 9 in. above the grate at the skewback, with a 9-in. spring, making 18 in. in the center of the arch.

For the horizontal baffle little need be said from the smoke standpoint as this combination is always satisfactory. Fig. D, Plate 1, shows a setting with 7 ft. 6 in. head room, which can be considered ideal for a chain grate. This dimension may vary considerably without affecting the performance. 6 ft. 6 in. may be considered the minimum head room allowable.

It sometimes happens that, with a tile-roof furnace and a low setting, the furnace gets so hot as to have a bad effect on the life of the brick work. This can be offset in many instances by baring the lower row of tubes, using T tile instead of box tile. This allows more rapid heat absorption into the boiler, increasing the life of the brick work and resulting in a better operating furnace.

*Double Inclined Stokers.*—For the double inclined type of stoker the short length of flame, discharging directly into the bank of tubes, is undesir-

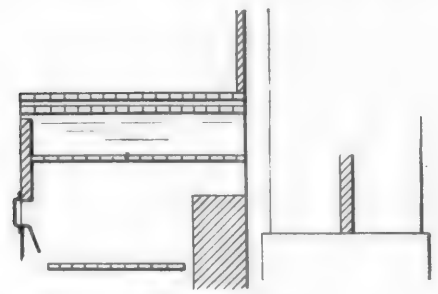

FIG. A Poor

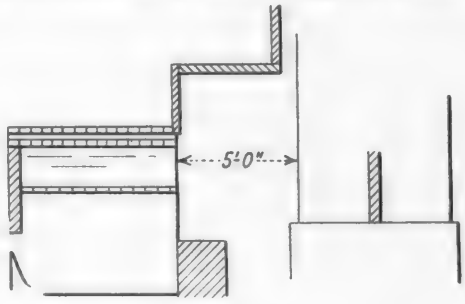


FIG. B Good

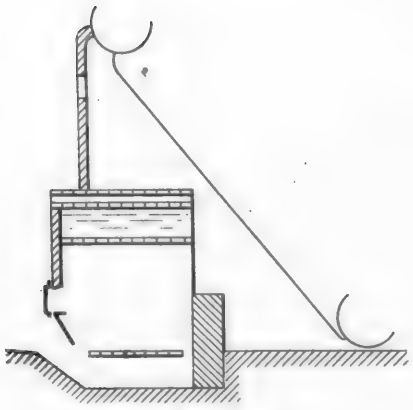

FIG. C Poor

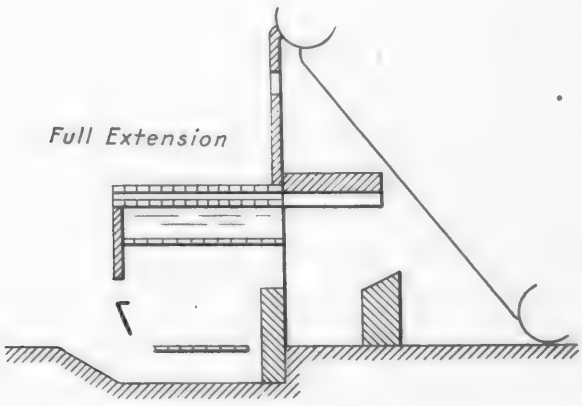


FIG. D Good

PLATE 3—DOUBLE-INCLINED STOKERS AND VERTICAL BOILERS.

able when the fire is being worked. This type of setting is frequently found installed in a 7-ft. head room, as in Fig. A, Plate 2. The human element enters strongly into the matter with such a setting, owing to the possibility of having considerable volatile matter pass off rapidly through carelessness. With a case of this kind it is better to set the boiler with a clearance of 10 ft. as in B, giving more opportunity for the gases to complete their combustion. One of the safest arrangements is to provide a tile-roof setting with an auxiliary bridge wall, Plate 2, Fig. C, breaking up the current of gases and insuring the mixture of any excess amount of volatile matter which may pass off for any cause whatever. The importance of setting this type of furnace with maximum flame travel is not always realized.

In Plate 3, two different types of boilers are shown with good and bad combustion of double inclined furnaces. It is a safe rule to get a full extension on this type of furnace and never resort to the flush front setting. In the case of Fig. A, Plate 3, the defect of short flame travel is corrected by providing a 5-ft. dog-house extension between the boiler and furnace and by raising the boiler to get the full benefit of the heating surface as shown in Fig. B. Typical Stirling settings are shown in C and D with flush front and full extension furnaces.

*Front-Feed Stokers.*—With the front-feed stoker the same practice should be observed as regards flame travel. A clearance of 7 ft. is not sufficient to get good results with this type of stoker and vertically baffled, water-tube boilers. A very much improved furnace can be obtained by using a head room of 10 ft. as in Fig. B, Plate 4, a combination resulting very satisfactorily from every standpoint. This design also gives an opportunity for employing a vertical bridge wall, which is nearly always found to be a desirable feature wherever it can be used, as the radiating

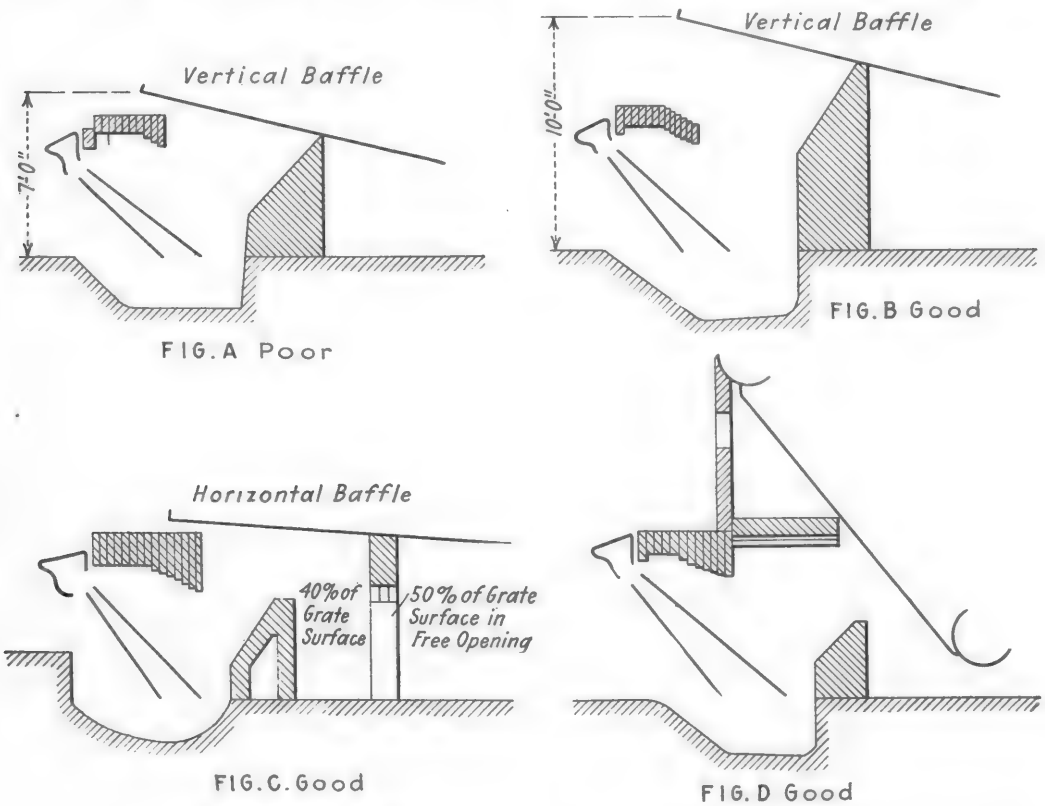


PLATE 4—COMBINATIONS OF FRONT-FEED STOKERS.

surface of the hot brick helps to keep the gases hot as they pass out of the furnace.

With a horizontal baffle it is a simple matter to combine this type of stoker successfully. Sufficient head room only is required to get the stoker under the front header. If this cannot be secured in the head room available, it does not alter the effectiveness of the design to excavate as shown in Fig. C. Sometimes piers, or deflection arches, are used with this setting to break up the current of gases. Where a free opening in such a setting does not go below 50 per cent. of the grate surface of the stoker, such construction is desirable. On a vertical boiler always get the maximum extension possible within reason.

*Underfeed Stokers.*—Underfeed stokers of different types require different head rooms. See Plate 5. The Jones and American types can give excellent results with a head room of 8 ft. 6 in. for a vertically baffled boiler, Fig. B, and 7 ft. for a horizontally baffled boiler. In the case of the former the effort should be to provide enough flame travel to minimize the danger of unconsumed volatile matter passing into the bank tubes.

In the case of tubular boilers the above named types of stokers can be installed with 42 in. from the dead plate to the shell, Fig. C, and the combination will result in a satisfactory performance. With stokers of the Taylor type, Fig. D, a 10-ft. clearance under the front header makes an ideal combination.

*Hand-Fired Settings.*—One of the most common types of boiler setting encountered is the ordinary hand-fired, return-tubular setting such as is indicated in Fig. A, Plate 6. In this setting there is no attempt made to accomplish a mixture of the gases after they have passed the bridge wall. The setting, while fairly efficient commercially, is very smoky with high volatile coal, and many attempts have been made to improve it. Fig. B, Plate 6, shows a full-extension, Dutch-oven setting by which it was attempted to improve the plain, hand-firing setting. From a smoke standpoint the Dutch-oven setting is a poor combination. Contrary to stoker practice where the fuel is introduced slowly and in small quantities, there is a considerable quantity of coal thrown on the fire at once. The strong radiation from the brick work above the fire has the effect of distilling the gases so rapidly that puffs of dense smoke will be made after firing in spite of every effort to prevent them. Fig. C, Plate 6, shows how to correct this defect by baring the shell to the direct radiation of the fire. This increases the steaming capacity and provides a high temperature zone back of the bridge wall where the gases must mix positively against the deflection arch, which breaks up the stratification and so promotes combustion.

It is not practical to combine a hand-fired, coal-burning furnace with a vertically baffled, water-tube boiler, but it is a simple matter to arrange such a furnace with a horizontal baffle, carrying out the same idea as in Fig. C. The ordinary hand-fired, horizontally-baffled, water-tube boiler furnace is covered with box tile and has nearly all the defects of the Dutch-oven shown in Fig. B, as it is practically a fire-brick enclosed furnace from which the volatile gases will be distilled at a very rapid rate. Fig. D indicates how this can be overcome. The changes indicated are, first, baring the first two rows of tubes over the fire by putting T tile on the second row, thereby avoiding the radiating effect of a mass of fire brick; second, installing a two-span deflection arch to break up the current of gases, as in the case of the return tubular boiler. In both of these furnaces a few simple proportions should be carried out to insure satisfactory results. There should be from 20 to 25 per cent. of the grate surface in free opening above the bridge wall. The free opening from the back of the bridge wall to the deflection arch should not be less than 40 per cent. of the grate surface, while the free opening under the deflection arch should be 50 per cent. of the grate surface. Hand-fired furnaces for high pressure work should be fitted with four air-syphon steam jets, spaced across the furnace above the fire doors, to be used when necessary.

### LOW PRESSURE HEATING PLANTS.

The foregoing discussion has been with reference to high pressure power work. The low pressure heating plant presents a problem that in some respects is more

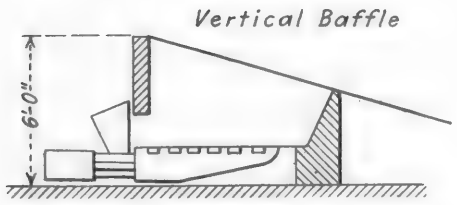


FIG. A Poor

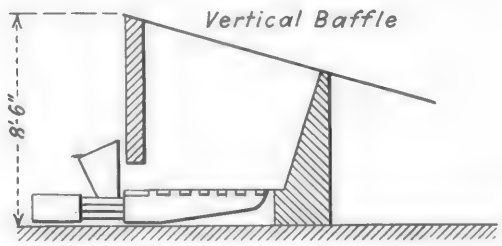


FIG. B Good

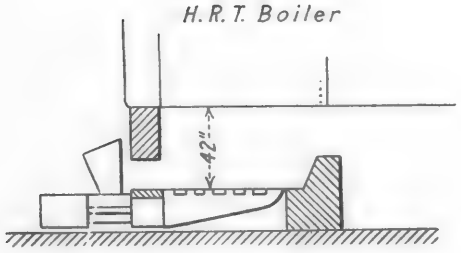


FIG. C Good

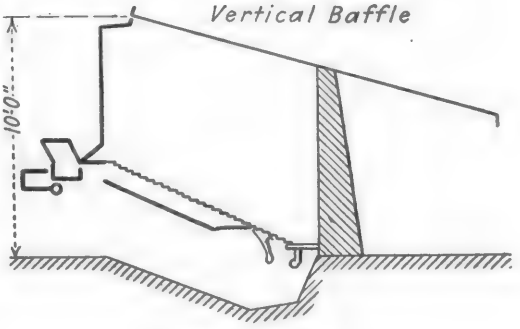


FIG. D Good

PLATE 5—HEAD ROOMS FOR UNDER-FEED STOKERS.

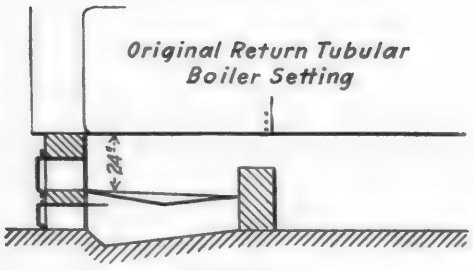


FIG. A

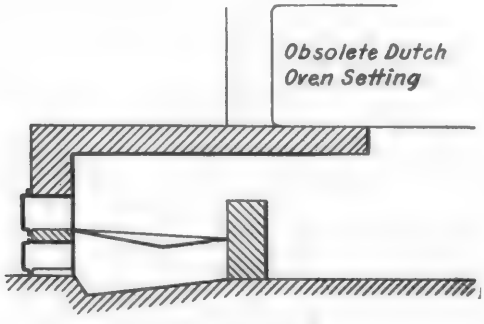


FIG. B

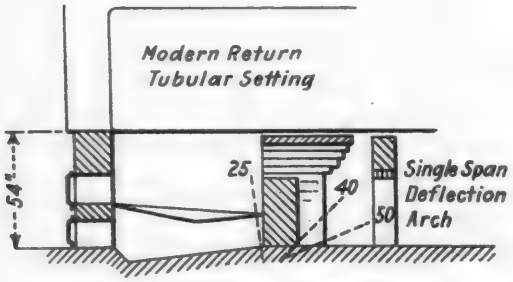


FIG. C % of Grate Surface

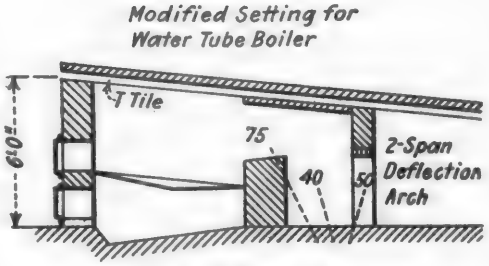


FIG. D % of Grate Surface

PLATE 6—DEVELOPMENT OF HAND-FIRED FURNACE.

difficult than any encountered in high pressure work. The plants are not ordinarily large enough to justify stokers, and, even if such was the case, the character of the attendance is not such as would do justice to the equipment. The temperatures are lower and no steam is available for steam jets or for power to drive apparatus. With such conditions as these to meet it has been found that the down draft principle works out very well.

A little study will show why this is so. there is accumulating on the water grate a thick bed of coked coal, which, when sliced down to the lower grate, does not make smoke because the volatile matter has all been distilled off. After slicing, the fire can be heavily charged with fresh coal, without disturbing the fuel bed and consequently without causing smoke. It is then in shape for another long undisturbed period.

Another advantage of the down draft principle on heating loads comes from the

Details of Single and Double Span Deflection Arches

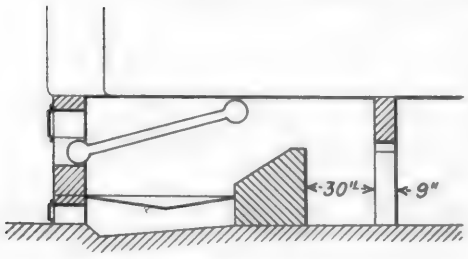


FIG. A Return Tubular

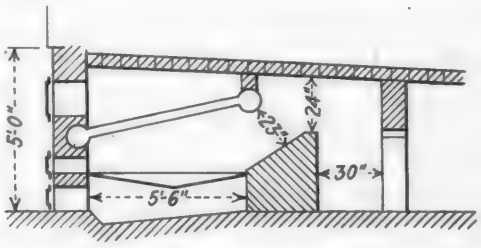


FIG. B Water Tube

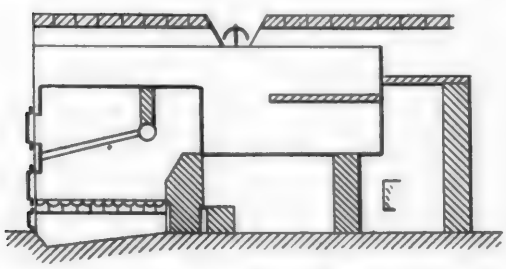

FIG. C Fire Box

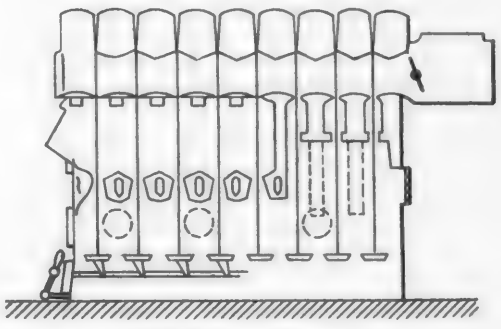

FIG. D Cast Iron

PLATE 7—TYPES OF DOWN-DRAFT EQUIPMENT FOR HEATING LOADS.

The danger of making smoke on a down draft furnace comes from getting green coal on the lower grate, so the longer the fire can remain undisturbed the less chance of making smoke. The rate of combustion on heating loads is low, and allows for long periods during which the fires are not disturbed and no smoke is made. During these undisturbed periods fact that although the rate of combustion may be at times extremely low, yet the water element directly in the fire furnishes a proportionate amount of steam no matter how low the combustion; so the system is more responsive than would be possible with a plain grate boiler.

The down draft principle can be applied to return tubular or water tube boil-

ers in the larger units. In these units it is advisable to spring an arch in the path of the gas as shown in Figs. A and B, Plate 7. As the rate of combustion on these large units at times approximates power conditions, it is desirable to guard against any excessive amount of volatile matter, which might pass over during these periods, by breaking up the current of gases and giving them an opportunity to burn.

For small units there has been developed in the past few years a number of types of self-contained, steel and cast iron boilers embodying the down draft principle. In the former type the water element consists of water tubes or pipes extended into headers in the ordinary manner and located in the fire box of a locomotive-type boiler. In the cast-iron, down draft type the water element is cast integrally with each section, forming the upper grate, the shape of the elements being such as to facilitate the slicing of coked coal down to the lower grate without disturbing the main body of fuel before the volatile matter has been distilled from it. This type is made in sizes up to 10,000 sq. ft. of radiation in one unit, and can be installed several in a battery.

In conclusion I wish to call attention to the necessity of being in possession of all the facts before attempting to work out any given smoke problem. There are so many variables such as head room, floor space, character of attendants, fuel, etc., to be taken into consideration that each job requires careful study before any recommendation can be made. When proper attention is given to the matter there is no question but what an installation can be obtained which will meet the local conditions.

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## *Determination of Radiator Sizes for Hot Water Heating Plants*

BASED ON A RULE APPLYING TO ALL WATER AND ROOM TEMPERATURES.

By FREYWID WEGELIUS.

In THE HEATING AND VENTILATING MAGAZINE for March and August, 1915, Charles A. Fuller and Charles D. Allan have treated in a very meritorious and instructive manner, the important subject of the rate of transmission of heat from radiating surfaces under different temperatures.

Some time ago the writer published, in Helsingfors, Finland, a treatise on this subject, developing a method for figuring radiator transmission, which will be found to be both time and labor-saving. With this method very reliable charts may be used by the practical engineer in calculating hot water radiators. The present article will discuss the theory while a subsequent article will take up the practical application and will be accompanied by the graphic charts mentioned.

After years of experiments, made with the greatest care by several men, prominent in the profession. it has been established that the quantity of heat emitted from a steam radiator is unequal to the heat emitted from a radiator filled with water at the same temperature as the steam and in other respects working under the same conditions as the steam radiator. Thus the coefficient of heat transmission, expressed in B.T.U. per hour per square foot per degree of

FIG. 1.—CROSS SECTIONS OF ONE AND TWO-COLUMN RADIATORS USED IN TESTS.

temperature difference between the heating medium and the surrounding air, is considerably higher for steam than for hot water. In the following the calculation of hot water radiators only is considered.

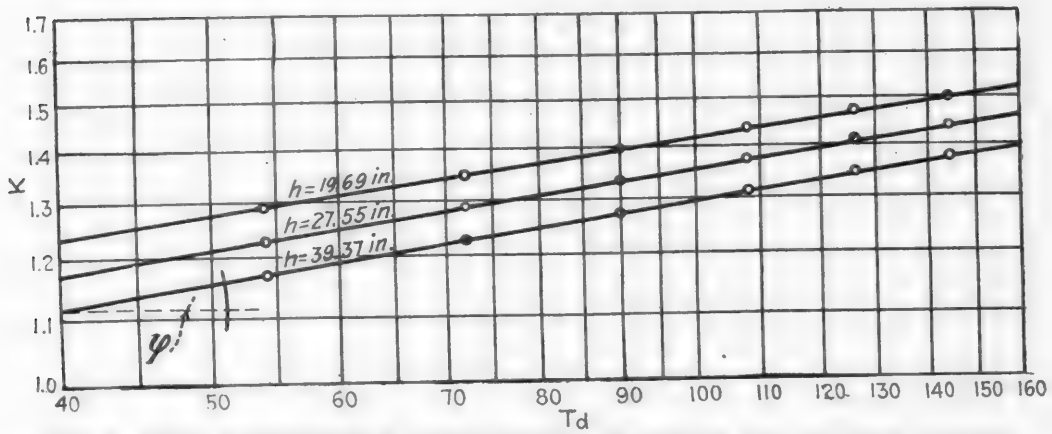



FIG. 2. HEAT TRANSMISSION COEFFICIENTS OF SINGLE AND DOUBLE COLUMN RADIATORS, FOR VARIOUS TEMPERATURE DIFFERENCES.

RULE FOR CALCULATING HOT WATER RADIATION.

The required surface of a hot water radiator may be calculated from the equation:

$$R = \frac{M}{K\ T_d}$$

In this equation

R = the required surface in square feet

M = the B.T.U. transmitted by the total radiator surface per hour

K = the co-efficient of heat transmission expressed in B.T.U. per hour per square foot per one degree of average temperature difference between the heated water and the surrounding air

$T_d$ = the average temperature difference between the heated water and the surrounding air.

This latter equals

$$\frac{T_i + T_o}{2} - T'$$

$T_i$ and $T_o$ being inlet and outlet water temperatures and T′ being the temperature of the surrounding air.

HEAT TRANSMISSION COEFFICIENTS AS DETERMINED BY TESTS.

The heat transmission coefficient values are given in the following table and the values may be accepted as reliable, due to the extreme care exercised in the experiments.

The radiator height is measured from center to center.

The fact that the transmission coefficients for 1 and 2-col. radiators of the same height are equal may be explained by the circumstance that there is hardly any difference in the cross sections of these radiators (see Fig. 1).

To get the corresponding values of K for all varying values of $T_d$ and the different radiator heights, within practical working limits, the values of K for 1 and 2-col. radiators are first plotted on logarithmic paper, as shown herewith, the vertical scale indicating the values of K

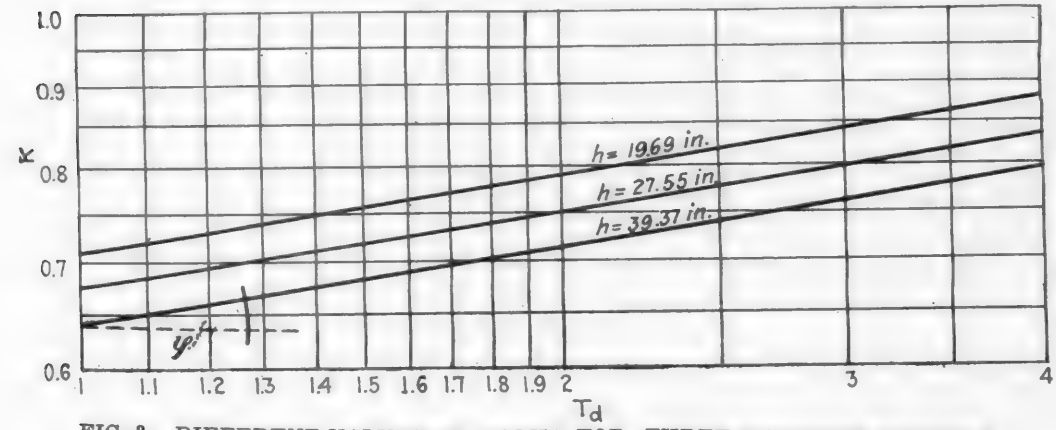



FIG. 3. DIFFERENT VALUES OF ALPHA FOR THREE RADIATOR HEIGHTS.

VALUES OF TRANSMISSION COEFFICIENT K.

| Kind of radiator. | Temperature difference, Deg. F. 54 | 72 | 90 | 108 | 126 | 144 |
|---|---|---|---|---|---|---|
| 1 and 2-col., 19.69 in. high | | | | | | |
| 1 and 2-col., 19.69 in. high | 1.29 | 1.35 | 1.39 | 1.43 | 1.48 | 1.50 |
| 1 and 2-col., 27.55 in. high | 1.23 | 1.29 | 1.33 | 1.37 | 1.41 | 1.43 |
| 1 and 2-col., 39.37 in. high | 1.17 | 1.23 | 1.27 | 1.31 | 1.35 | 1.37 |
| 3-col., 19.69 in. high | 1.15 | 1.21 | 1.27 | 1.31 | 1.33 | 1.35 |
| 3-col., 27.55 in. high | 1.11 | 1.17 | 1.21 | 1.25 | 1.27 | 1.29 |
| 3-col., 39.37 in. high | 1.07 | 1.13 | 1.17 | 1.21 | 1.23 | 1.25 |

and the horizontal scale the values of $T_d$. The points indicated are found to be in a straight line, the equation of which takes the form:

$$\log K = \log \alpha + \operatorname{tg} \varphi \times \log T_d \text{ or}$$

$$K = \alpha\ T_d^{\operatorname{tg}\varphi}$$

A height of 19.69 in gives $\operatorname{tg} \varphi = 0.148$
A height of 27.55 in. gives $\operatorname{tg} \varphi = 0.151$
A height of 39.37 in. gives $\operatorname{tg} \varphi = 0.155$

*Although this table shows that tg $\varphi$ changes somewhat with the radiator height, the change is so slight that we may consider tg $\varphi$ as a constant for the three heights and put it at 0.151*

By taking $T_d = 1$, we get

$$\log K = \log \alpha + \operatorname{tg} \varphi \times \log 1, \text{ or}$$

$$K = \alpha$$

By means of the chart shown in Fig. 3, these three different values are plotted. Substituting in the formula, they give the following values of K:

Height 19.69 in.....$K = 0.709\ T_d^{0.151}$
Height 27.55 in.....$K = 0.676\ T_d^{0.151}$
Height 39.37 in.....$K = 0.654\ T_d^{0.151}$

To get the values of K for all other radiator heights, the diagrams shown in Figs. 4 and 5 are made, the vertical scale indicating radiator heights, and the horizontal scale, the values of $\alpha$ as above. The straight line connecting the points plotted is again represented by the equation:

$$\log \alpha = \log \beta + \operatorname{tg} \psi \times \log h \text{ or}$$

$$\alpha = \beta h^{\operatorname{tg}\psi}$$

h bring the center to center height of the radiator and $\operatorname{Tg} \psi = -0.13$

If $h = 1$ $\log \alpha = \log \beta + \operatorname{tg} \psi \times \log 1$, and $\alpha = \beta$

From fig. 5 the value of $\beta$ is obtained and hence is

$$\alpha = 1.043\ h^{-0.13} \text{ or}$$

$$\alpha = 1.043\ h \frac{1}{h^{0.13}}$$

If this value is substituted for $\alpha$, the equations above for 1 and 2-col. radiators take the general form:

$$K = 1.043 \frac{T_d^{0.151}}{h^{0.13}}$$

In a similar manner, the values of K are obtained for 3 and 4-col. radiators, $\alpha$ for 4-col. radiators having been assumed proportional to its value for 1, 2 and 3-col. radiators:

1 and 2-col., 19.69 in. high...$0.709\ T_d^{0.151}$
1 and 2-col., 27.55 in. high...$0.676\ T_d^{0.151}$
1 and 2-col., 39.37 in. high...$0.645\ T_d^{0.151}$
3-col., 19.69 in. high .....$0.639\ T_d^{0.151}$
3-col., 27.55 in. high .....$0.613\ T_d^{0.151}$
3-col., 39.37 in. high .....$0.592\ T_d^{0.151}$

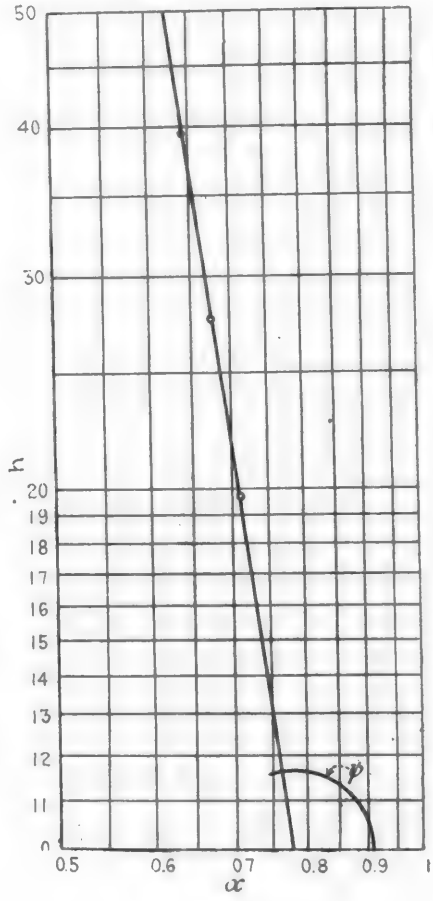



FIG. 4.

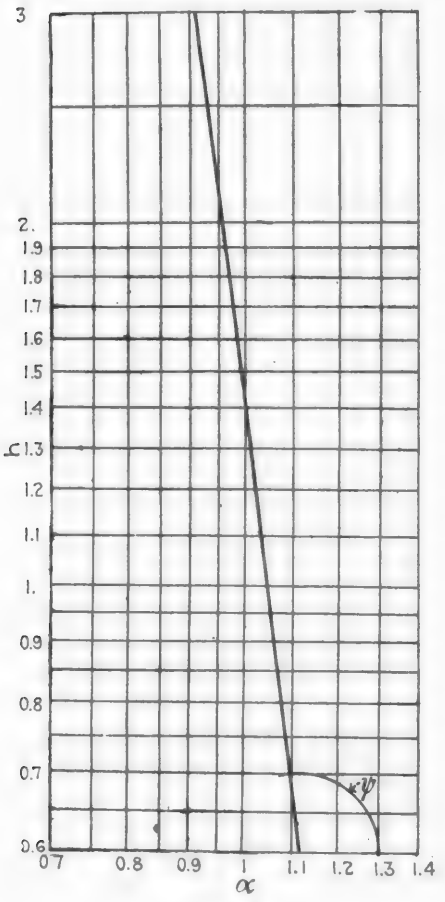



FIG. 5.

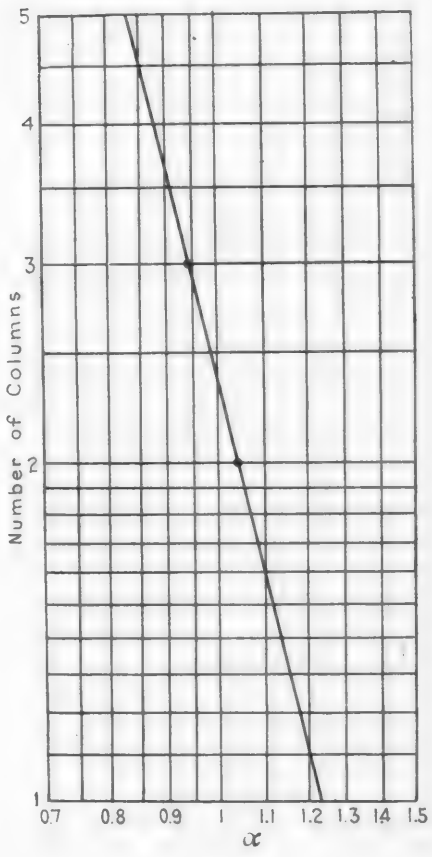



FIG. 6.

GENERAL EXPRESSION OF

| | K | R | M |
|---|---|---|---|
| 1 and 2 column radiators | $1.043 \frac{T_d^{0.151}}{h^{0.13}}$ | $\frac{1}{1.043} \frac{h^{0.13}M}{T_d^{1.151}}$ | $1.043 \frac{T_d^{1.151}R}{h^{0.13}}$ |
| 3 column radiators | $0.944 \frac{T_d^{0.151}}{h^{0.13}}$ | $\frac{1}{0.944} \frac{h^{0.13}M}{T_d^{1.151}}$ | $0.944 \frac{T_d^{1.151}R}{h^{0.13}}$ |
| 4 column radiators | $0.882 \frac{T_d^{0.151}}{h^{0.13}}$ | $\frac{}{0.882} \frac{h^{0.13}M}{T_d^{1.151}}$ | $0.882 \frac{T_d^{1.151}R}{h^{0.13}}$ |

In a subsequent article the writer will show how to determine surfaces, lengths, number of sections, etc., of hot water radiators, without any need of calculations, by using simple charts based upon the foregoing considerations.

# The Heat Insulating Properties of Commercial Steam Pipe Coverings

By L. M. McMillan.

*(From a paper presented at the recent annual meeting of the American Society of Mechanical Engineers.)*

An enormous amount of effort has been extended in attempts to determine accurately the savings effected by the use of non-conducting coverings on steam pipes. But even with the results of all these investigations available, little reliable information is on hand regarding the efficiencies of pipe coverings in commercial use at the present time.

In general, the results of previous tests of heat insulating materials apply at only one temperature, or at most two, and for one or two thicknesses and are not sufficient to determine the laws which govern the flow of heat at different temperatures and for different thicknesses. Therefore, this work fails where an attempt is made to apply the results to modern conditions involving high superheat and thicker coverings.

The work which this paper describes has been carried on for a period of about two years at the University of Wisconsin. The effect on heat losses of varying the temperature difference between pipe surface and air between limits of 0° and 500° F. has been thoroughly investigated. Different thicknesses of material from 0 up to 3 in. were tested and the laws confirmed by the results of these tests permit of their application to any thickness. The drop in temperature from steam in a pipe to the inner and outer surfaces of the pipe wall under various conditions has been accurately determined. Another new fact brought out was that the loss from any covered pipe is a function of the temperature difference between the surface of the covering and the surrounding air; and this function is the same for all coverings having the same character of surface regardless

FIG. 1. ARRANGEMENT OF TESTING APPARATUS FOR STEAM PIPE COVERINGS.

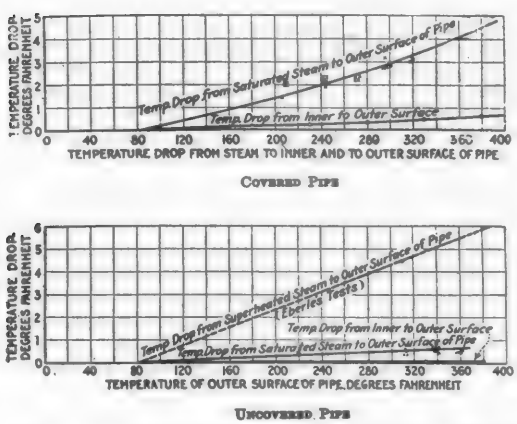

TEMPERATURE DROP, DEGREES FAHRENHEIT
Temp. Drop from Saturated Steam to Outer Surface of Pipe
Temp. Drop from Inner to Outer Surface
TEMPERATURE DROP FROM STEAM TO INNER AND TO OUTER SURFACE OF PIPE
Covered Pipe
TEMPERATURE DROP, DEGREES FAHRENHEIT
Temp. Drop from Superheated Steam to Outer Surface of Pipe
(Eberle Tests)
Temp. Drop from Inner to Outer Surface
Temp. Drop from Saturated Steam to Outer Surface of Pipe
TEMPERATURE OF OUTER SURFACE OF PIPE, DEGREES FAHRENHEIT
Uncovered Pipe

FIG. 2. TEMPERATURE DROP FROM STEAM TO INNER AND OUTER SURFACES OF PIPE.

of what the other properties of the covering may be, since the effects, if any, of these properties appear in the temperature difference. The value of the function has been determined for canvas covered surfaces.

In the tests here discussed, it was proposed to heat a section of covered pipe by means of an electric heater made up of resistance coils immersed in oil inside the pipe, and to calculate the amount of heat lost through the covering by measuring the energy required to hold the outside metal of the pipe at a constant known temperature. Under such conditions it is evident that just enough energy is being supplied to compensate for the losses through the covering; otherwise the excess or deficiency of energy will cause the pipe to heat up or cool off as the case may be. This must be true for, according to the law of conservation of energy, all the energy entering must appear as heat since none is transformed into any other form and none is lost. Fig. 1 is a photograph of the apparatus used for the tests.

(The author brought out the fact that the drop in temperature from the steam to the outside surface of a pipe was probably different than from oil to the same point on account of the different conductivities of these substances.)

The method of test provided for the measuring of the temperature of the outside of the pipe and not of the oil, so that in order to make the results applicable directly to steam conditions it is only necessary to establish a relation between the temperature of steam in a pipe and that of the outer surface of the pipe wall. This difference of temperature has been entirely neglected by most investigators, being accurately measured by none and considered not to exist by most.

Tests made by the author to determine this point showed that the drop in temperature through the wall of a covered pipe containing saturated steam is so small in comparison with the total drop

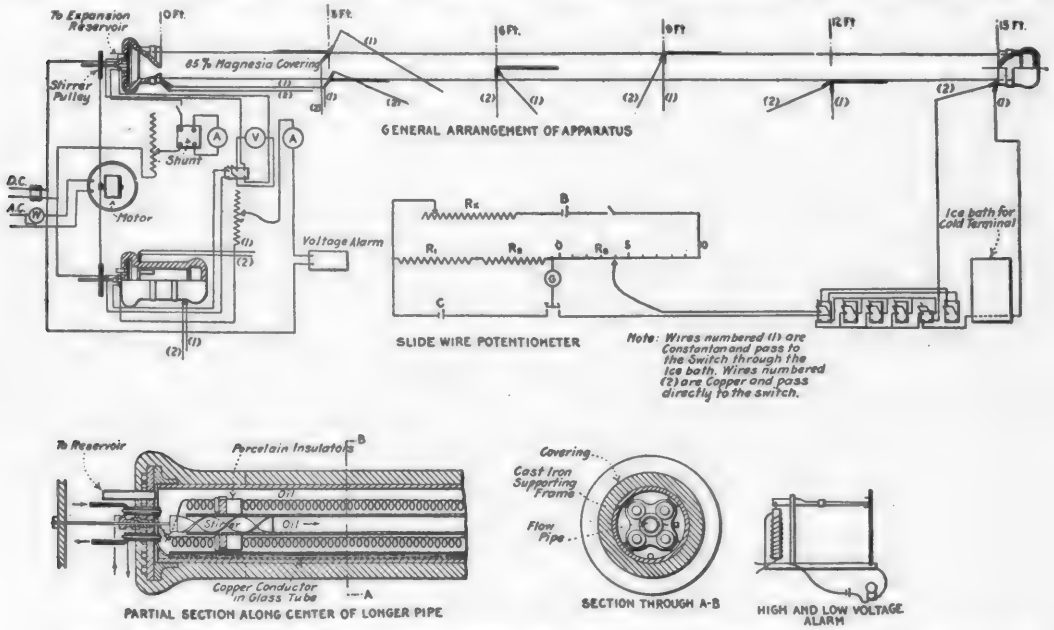



FIG. 3. APPARATUS FOR OBTAINING HEAT LOSSES THROUGH PIPE COVERINGS.

from steam temperature to room temperature that it may be neglected entirely. However, for superheated steam it should be taken account of, and the steam temperature obtained by adding to pipe temperature the corresponding correction, which may be estimated from Fig. 2.

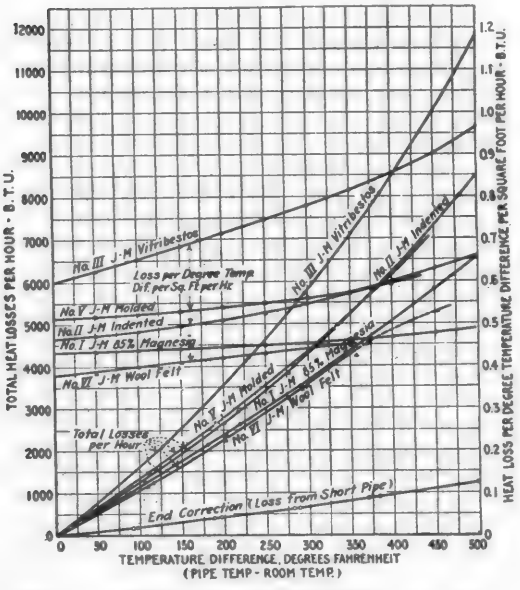

TOTAL HEAT LOSSES PER HOUR - B.T.U.
HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR - B.T.U.
No. III J-M Vitribestos
No. V J-M Molded
No. II J-M Indented
No. I J-M 85% Magnesia
No. VI J-M Wool Felt
Loss per Degree Temp. Dif. per Sq. Ft. per Hr.
Total Losses per Hour
End Correction (Loss from Short Pipe)
TEMPERATURE DIFFERENCE, DEGREES FAHRENHEIT
(PIPE TEMP - ROOM TEMP.)

FIG. 4. TESTS OF COVERINGS I, II, III, V AND VI.

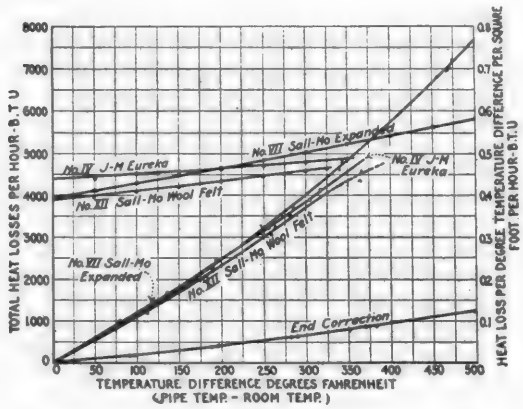

TOTAL HEAT LOSSES PER HOUR - B.T.U.
HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR - B.T.U.
No. IV J-M Eureka
No. XII Sall-Ma Wool Felt
No. VII Sall-Ma Expanded
No. XII Sall-Ma Wool Felt
End Correction
TEMPERATURE DIFFERENCE DEGREES FAHRENHEIT
(PIPE TEMP. - ROOM TEMP.)

FIG. 5. TESTS OF COVERINGS IV, VII AND XII.

The apparatus used for making the tests was described by the author at length and is shown in the accompanying illustration (Fig. 3). The test pipe is a 16-ft. section of standard 5-in. steel pipe closed at the ends and filled with gas engine cylinder oil. It contains also resistance coils which serve as an electric heater and a stirring device for keeping the oil in circulation. The remainder of the apparatus consists of the electrical instruments for measuring the energy input, a small electric motor for driving the circulating propeller, the thermometers for room temperature, and the thermo-couples and potentiometer for

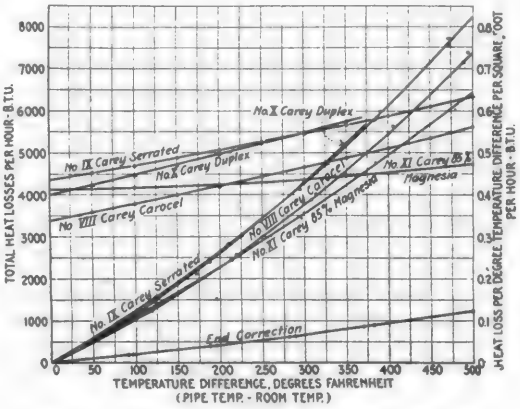

TOTAL HEAT LOSSES PER HOUR - B.T.U.
HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR - B.T.U.
No. X Carey Duplex
No. IX Carey Serrated
No. X Carey Duplex
No. XI Carey 85% Magnesia
No. VIII Carey Carocel
No. VIII Carey Carocel
No. XI Carey 85% Magnesia
No. IX Carey Serrated
End Correction
TEMPERATURE DIFFERENCE, DEGREES FAHRENHEIT
(PIPE TEMP. - ROOM TEMP.)

FIG. 6. TESTS OF COVERINGS VII, IX, X AND XI.

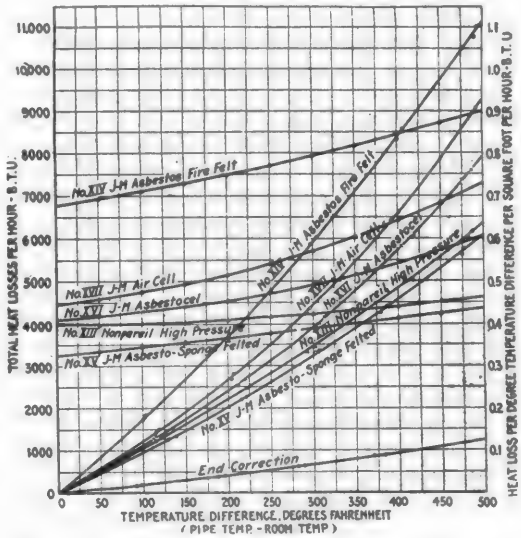

TOTAL HEAT LOSSES PER HOUR - B.T.U.
HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR - B.T.U.
No. XIV J-M Asbestos Fire Felt
No. XIII J-M Asbestos Fire Felt
No. XVIII J-M Air Cell
No. XVI J-M Asbestocel
No. XIII Nonpareil High Pressure
No. XV J-M Asbesto-Sponge Felted
No. XIII Nonpareil High Pressure
No. XV J-M Asbesto-Sponge Felted
End Correction
TEMPERATURE DIFFERENCE, DEGREES FAHRENHEIT
(PIPE TEMP. - ROOM TEMP.)

FIG. 7. TESTS OF COVERINGS XIII, XIV, XV, XVI AND XVII.

measuring the temperature of the pipe.

The coverings, before being tested for their heat insulating qualities, were placed on the steam pipe and allowed to dry for a week. Steam in the pipe was kept at about 130 lbs. pressure throughout that time.

During the tests the room tempera-

ture was taken as the average of the readings of five thermometers at different points in the room and all about equidistant from the pipe. These were shielded from direct radiation from the pipe by paper screens placed between them and the pipe so that they registered the correct temperature of the air

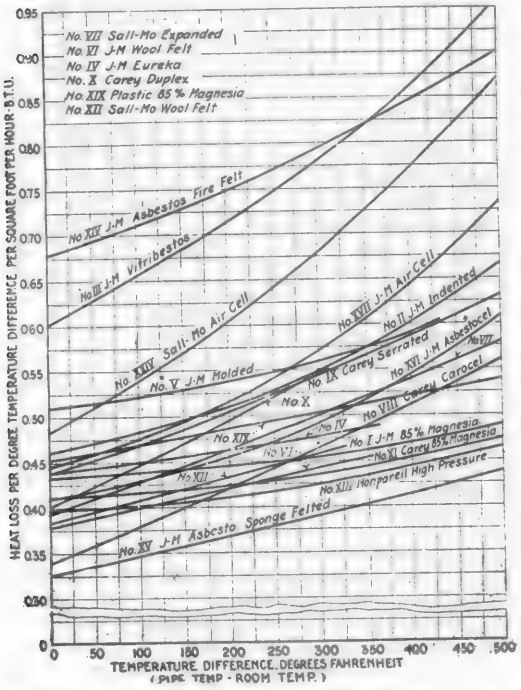



FIG. 8. SUMMARY OF RESULTS ON SINGLE THICKNESS COVERINGS.

in the room. All doors and windows of the room were kept closed during the tests.

### THREE IMPORTANT FACTORS IN DETERMINING HEAT TRANSMISSION.

The three factors most important in determining the amount of heat that will be transmitted by a given insulating material are (1) the character of the material, or, in other words, its conductivity; (2) the temperature difference between its two boundaries, and (3) the thickness of the layer of material. The others of lesser importance are the character of the surface and the velocity of the air fanning that surface. These last two were kept constant during all tests. but the effect of varying them with all other conditions constant was not determined. This, however, is contemplated for the near future.

The character of materials was varied while temperature range and thickness were kept constant by making tests of 17 different pipe coverings of approximately the same thickness and subjected to the same temperatures. The effect of the character of the material is shown in Fig. 8.

Tests were made at pipe temperatures ranging from 175° to 575° F. and at least eight or ten tests were made on each material. This was varying the temperature while character of material and thickness remained the same. The effect of temperature on the losses is shown in Figs. 4 to 8. The excellent agreement of many tests is the best indication of the accuracy of the work.

For two different materials the thickness was varied from 0 to 3 ins., while in each case material and temperature range were constant. The effect of thickness is shown in Figs. 9 to 12.

All the coverings tested were bought in the open market and the dealers were given no intimation that the coverings ordered were to be tested.

### DISCUSSION OF RESULTS.

The results of the test on bare pipe are shown in Fig. 13. The curve of net heat losses per degree temperature difference per square foot per hour shows that this loss is far from being a constant at all temperatures as has been assumed or implied by most former investigators.

Figs. 4 to 7, inclusive, show curves from tests of 17 different coverings of single thickness, i. e., about 1-in. As will be seen, the radiation and convection from the surface of the covering increases at a more rapid rate than the temperature as the pipe is heated up. But the principal reason for the increase in the rate of losses in the case of covered pipe is within the covering itself. Where the air spaces in the coverings are large, heat is transmitted through them by radiation and convection, in addition to the heat that is conducted by the solid material. This accounts for the greater slope of the rate curves for air cell and similar coverings than for magnesia, diatomaceous earth, etc.

The net heat loss curves from all the tests of coverings 1 in. thick are assembled in the form of a general summary

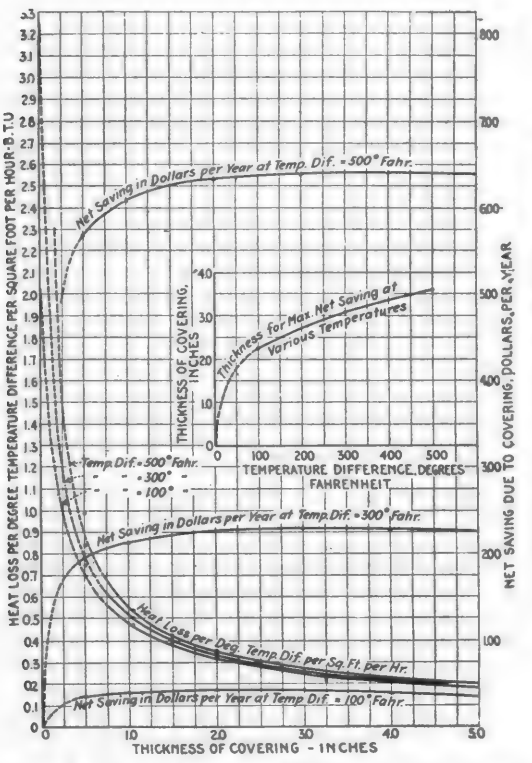

HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR - B.T.U.
NET SAVING DUE TO COVERING, DOLLARS, PER YEAR
THICKNESS OF COVERING - INCHES
Net Saving in Dollars per Year at Temp. Dif. = 500° Fahr.
Net Saving in Dollars per Year at Temp. Dif. = 300° Fahr.
Net Saving in Dollars per Year at Temp. Dif. = 100° Fahr.
Heat Loss per Deg. Temp. Dif. per Sq. Ft. per Hr.
Temp. Dif. = 500° Fahr.
" = 300° "
" = 100° "
THICKNESS OF COVERING, INCHES
Thickness for Max. Net Saving at Various Temperatures
TEMPERATURE DIFFERENCE, DEGREES FAHRENHEIT

FIG. 9. THICKNESS-SAVINGS CHART FOR 85% MAGNESIA COVERINGS.

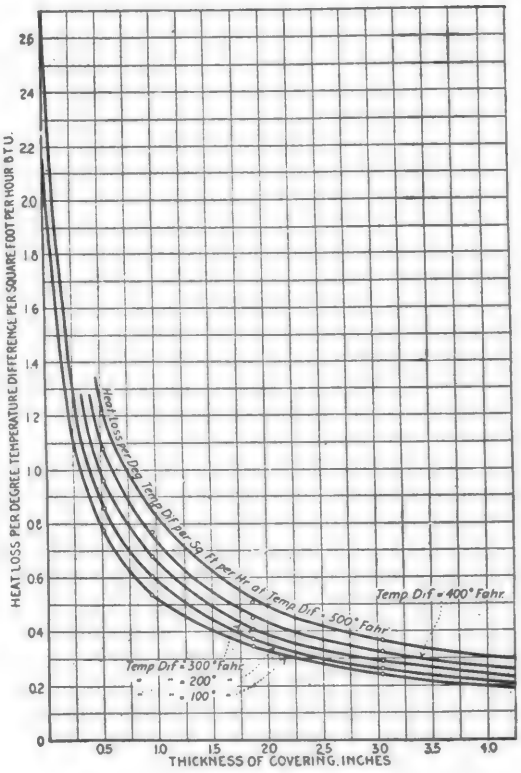

HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR B.T.U.
THICKNESS OF COVERING, INCHES
Heat Loss per Deg. Temp. Dif. per Sq. Ft. per Hr. at Temp. Dif. = 500° Fahr.
Temp. Dif. = 400° Fahr.
Temp. Dif. = 300° Fahr.
" = 200° "
" = 100° "

FIG. 11. THICKNESS HEAT LOSS CURVES FOR SMALL-MO CELL COVERINGS.

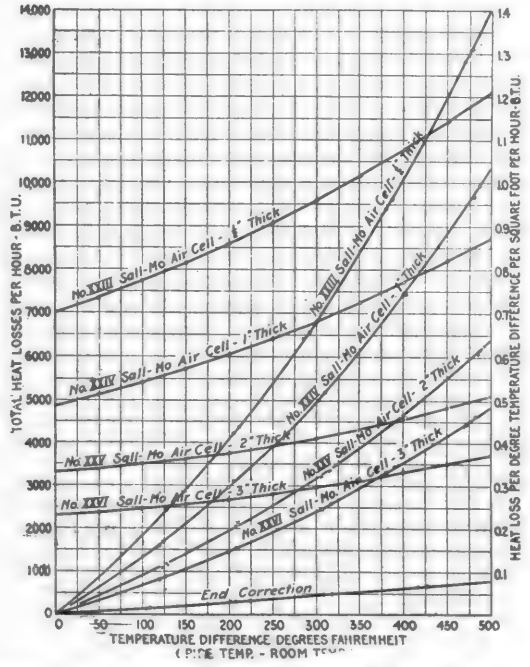
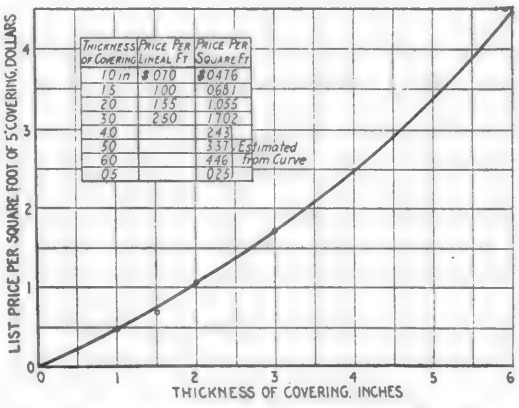

TOTAL HEAT LOSSES PER HOUR - B.T.U.
HEAT LOSS PER DEGREE DIFFERENCE PER SQUARE FOOT PER HOUR-B.T.U.
No. XXIII Sall-Mo Air Cell - ½" Thick
No. XXIII Sall-Mo Air Cell - 1" Thick
No. XXIV Sall-Mo Air Cell - 1" Thick
No. XXIII Sall-Mo Air Cell - 1½" Thick
No. XXIV Sall-Mo Air Cell - 2" Thick
No. XXV Sall-Mo Air Cell - 2" Thick
No. XXV Sall-Mo Air Cell - 3" Thick
No. XXVI Sall-Mo Air Cell - 3" Thick
No. XXVI Sall-Mo Air Cell - 4" Thick
End Correction
TEMPERATURE DIFFERENCE DEGREES FAHRENHEIT

FIG. 10. TESTS OF COVERINGS XXIII TO XXVI.




| Thickness of Covering | Price Per Lineal Ft | Price Per Square Ft |
|---|---|---|
| 1.0 in | $ 070 | $0476 |
| 1.5 | 100 | 0681 |
| 2.0 | 155 | 1055 |
| 3.0 | 250 | 1702 |
| 4.0 | | 243 |
| 5.0 | | 337 Estimated |
| 6.0 | | 446 from Curve |
| 0.5 | | 0251 |

FIG. 12. STANDARD LIST PRICE OF 5-IN. PIPE COVERINGS.

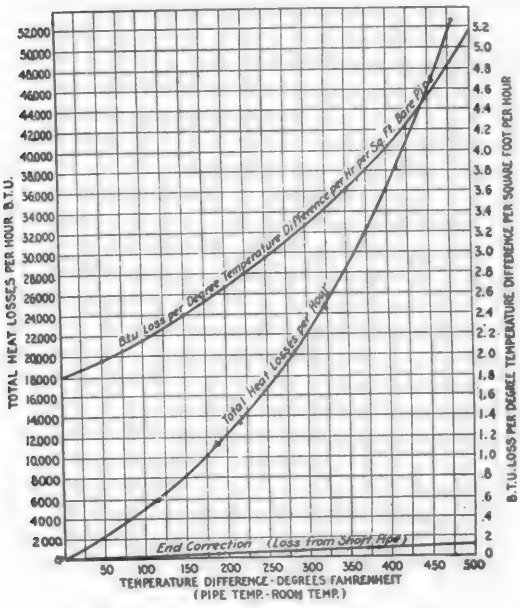

TOTAL HEAT LOSSES PER HOUR B.T.U.
B.T.U. LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR
Btu Loss per Degree Temperature Difference per Hr. per Sq. Ft. Bare Pipe
Total Heat Losses per Hour
End Correction (Loss from Short Pipe)
TEMPERATURE DIFFERENCE-DEGREES FAHRENHEIT
(PIPE TEMP.-ROOM TEMP.)

FIG. 13. TEST OF BARE PIPE.

in Fig. 8. From the curves shown in this figure, one can tell at a glance what coverings are the more efficient at any temperature. Of all the coverings tested the four best, at temperatures of 200° to 600° F. are J-M asbestos-sponge felted, Nonpareil high pressure, Carey 85% magnesia and J-M 85% magnesia, ranking in the order named, with the first well ahead of all the others. Those losing the greatest amount of heat were J-M vitrebestos and J-M firefelt. The first of these latter is little used as a pipe covering, being employed mostly for stack linings, etc., while the virtue of the second is in its being a heat-proof material suitable for use as the layer in contact with a pipe carrying superheated steam, where the better insulating material used for the outer layers could not stand the temperature of superheat.

The saving in dollars per year due to use of covering has been calculated for each of the coverings tested and the results were given in a table. Also, the first cost of the covering is taken account of and values of net saving and per cent. saving on investment are given for values of temperature differences of from 1° to 500° F. The saving in B.T.U. per degree temperature difference per square foot per hour was first found for each temperature by subtracting from the bare pipe losses at that temperature the loss from covered pipe at the same temperature. Then the total saving per square foot for a year of 365 24-hr. days was found by multiplying the saving per degree per hour per square foot by 8,760 and by the temperature.

The cost of heat was taken at $0.30 per 1,000,000 B.T.U., which is nearly equivalent to $0.30 per 1,000 lbs. of steam. Using this value, the saving in dollars per square foot per year was computed. The first cost of covering was ascertained from the manufacturers, and 10 per cent. of the list price was added for erecting and 10 per cent. more for painting. The cost of covering per year was taken as 14 per cent. of the total first cost, the 14 per cent. including interest, depreciation, repairs, insurance, etc The difference between the total saving per year and the cost of covering per year is the net saving per year.

The results of tests on ½-in., 1-in., 2-in. and 3-in. thicknesses of plastic 85% magnesia are given in Fig. 14. Fig. 9 shows the variation of losses with thickness at temperature difference of 100°, 300° and 500° F. and for thicknesses from 0 to 4 ins. These curves were plotted from data calculated from a theoretical equation, using constants determined in the tests herein described. The points marked 0 are values from the actual experiments and they fall on the calculated curves with remarkable regu-

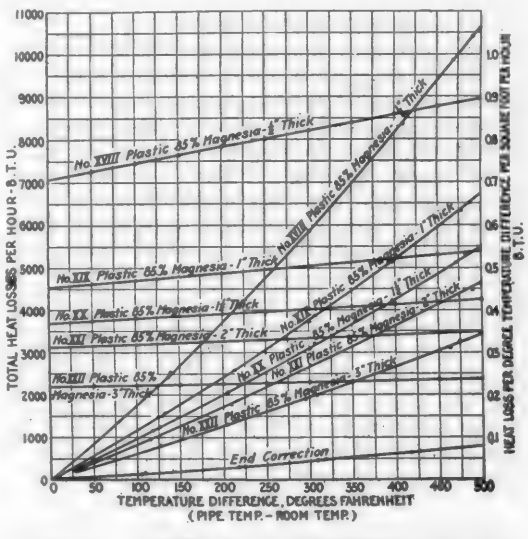

TOTAL HEAT LOSSES PER HOUR-B.T.U.
HEAT LOSS PER DEGREE TEMPERATURE DIFFERENCE PER SQUARE FOOT PER HOUR B.T.U.
No. XVIII Plastic 85% Magnesia-½" Thick
No. XVIII Plastic 85% Magnesia-1" Thick
No. XIX Plastic 85% Magnesia-1" Thick
No. XIX Plastic 85% Magnesia-1½" Thick
No. XX Plastic 85% Magnesia-1½" Thick
No. XX Plastic 85% Magnesia-2" Thick
No. XXI Plastic 85% Magnesia-2" Thick
No. XXI Plastic 85% Magnesia-3" Thick
No. XXII Plastic 85% Magnesia-3" Thick
End Correction
TEMPERATURE DIFFERENCE, DEGREES FAHRENHEIT
(PIPE TEMP.-ROOM TEMP.)

FIG. 14. TESTS OF COVERINGS XVIII TO XXII.

larity except at the ½-in. and 3-in. points.

Figs. 10 and 11 show results of similar tests on different thicknesses of air cell covering. These two coverings, magnesia and air cell, were chosen because of their being representative of the two different classes of materials, i. e., those with very small air spaces and those with rather large air spaces.

The yearly net saving in dollars were calculated for various thicknesses of J-M sectional 85% magnesia at temperature differences of 100°, 300° and 500° F. The variation of standard list prices with thickness is shown in Fig. 12. These values were used in computing the cost per year of the various thicknesses of coverings and results are given in Table 1.

The curves for net savings per square foot per year in Fig. 9 show a rapid increase in savings as the thickness is increased up to a point of maximum savings after which there is a decrease owing to the rapid increase in cost of covering. Fig. 9 shows the proper thickness for the maximum net saving at any temperature difference from 0° to 500° F.

The chart for proper thickness mentioned above applied only to the case where steam costs $0.30 per 1,000 lbs. and is on 365 days in the year. Fig. 15 is a chart for proper thickness of magnesia covering to be used at any temperature, any price of steam and any number of hours service per year. The chart

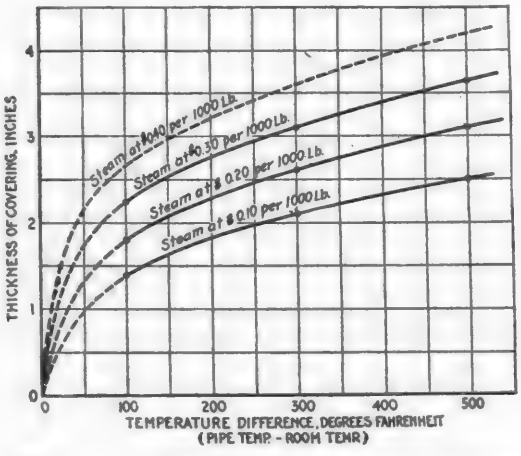



FIG. 15. CHART FOR DETERMINING PROPER THICKNESS OF 85% MAGNESIA FOR MAXIMUM NET SAVINGS AT VARIOUS TEMPERATURES AND PRICES OF STEAM.

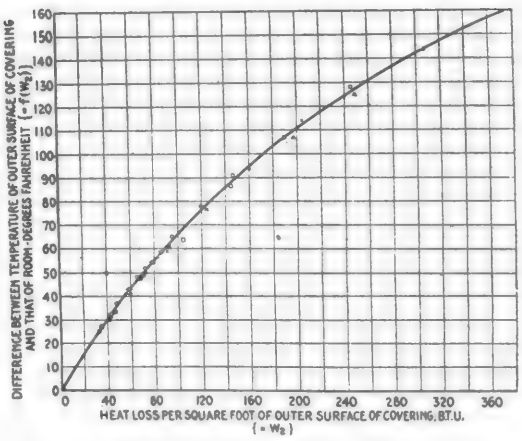



FIG. 16. CURVE SHOWING RELATION OF HEAT LOSSES TO TEMPERATURE DIFFERENCE BETWEEN COVERING SURFACE AND SURROUNDING AIR.

does not show values for length of service, but to use it for other periods than 365 days at 24 hours a day, multiply the price of steam by the number of hours per year the steam line considered is in service and divide by 8,760 and, using the result as the price of steam on the chart, find the proper thickness.

For example, suppose that the steam pressure is 150 lbs. per square inch gauge, that it costs $0.30 per 1,000 lbs. generated, and that the line is in use 12 hours a day and 9 months out of the year. The number of hours per year that the steam is on is therefore 2,920, or 1/3 of the time. The price of steam to be used on the chart is 0.30 (2920/8760) = $0.10. The temperature of the pipe containing steam at 150 lbs. gauge pressure will be about 365° F., and assuming a room temperature of 80° the temperature difference between pipe and room will be 285° F. Now on the chart, using the curve for steam at $0.10 per 1,000 lbs., the proper thickness corresponding to 285° temperature difference is found to be 2.1 in. This, then, is the proper thickness for maximum net saving under the given conditions.

In conclusion it may be said that in most cases it pays to use the best commercial pipe covering obtainable; because where the material is paid for many times over during the first year by the saving effected by its use, the first cost loses much of its weight as a determining factor in the selection of type of cov-

ering to be used. In view of the results of the thickness tests, it is a deplorable fact that few steam lines at the present time are provided with thick enough a covering for the greatest net saving. However, where fuel is cheap and the wasted and the object of covering the pipes at all is to keep tunnels, etc., cool enough that men may work in them. Therefore, a careful study of conditions is necessary before a certain type of covering can be recommended for a given

TABLE 1. DATA ON EFFICIENCIES AND SAVINGS OF VARIOUS THICKNESSES OF 85% MAGNESIA COVERING.

| Temperature Difference | Thickness | B.t.u./Sq.ft./deg.dif./hr. | | | Saving | Efficiency | Total Saving/yr. | | First Cost of Covering | Cost of Covering/yr. | Net Saving |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bare Pipe | Plastic 85 per cent Magnesia | Sectional 85 per cent Magnesia | | | B.t.u | Dollars (Steam at 30c/1000 lb.) | | | |
| 100 | 0.5 | 2 152 | 0.735 | 0.691 | 1.461 | 67.8 | 1,280,000 | 0.384 | 0 125 | 0.018 | 0.366 |
| 100 | 1.0 | | 0.492 | 0.462 | 1.690 | 78.4 | 1,481,000 | 0.444 | 0.238 | 0.033 | 0.411 |
| 100 | 2.0 | | 0.319 | 0.300 | 1.852 | 85.5 | 1,622,000 | 0.486 | 0.341 | 0.048 | 0 438 |
| 100 | 3.0 | | 0.248 | 0.233 | 1.919 | 89.1 | 1,681,000 | 0.504 | 0.528 | 0.074 | 0.430 |
| 100 | 4.0 | | 0.209 | 0.196 | 1.956 | 90.8 | 1,714,000 | 0.514 | 0.851 | 0 119 | 0.395 |
| 100 | 5.0 | | 0.185 | 0.174 | 1.978 | 91.9 | 1,733,000 | 0.520 | 1.215 | 0 170 | 0.350 |
| 300 | 0.5 | 3.260 | 0.805 | 0.757 | 2.503 | 76.8 | 6,579,000 | 1.975 | 0.125 | 0.018 | 1.957 |
| 300 | 1.0 | | 0.524 | 0.493 | 2.767 | 84.9 | 7,270,000 | 2.181 | 0.238 | 0.033 | 2.148 |
| 300 | 2.0 | | 0.335 | 0.315 | 2.945 | 90.4 | 7,740,000 | 2.322 | 0.341 | 0.048 | 2.274 |
| 300 | 3.0 | | 0.260 | 0.244 | 3.016 | 92.5 | 7,922,000 | 2.377 | 0.528 | 0.074 | 2.303 |
| 300 | 4.0 | | 0.219 | 0.206 | 3.054 | 93.7 | 8,026,000 | 2.408 | 0.851 | 0.119 | 2.289 |
| 300 | 5.0 | | 0.192 | 0.181 | 3.079 | 94.4 | 8,090,000 | 2.427 | 1.215 | 0.170 | 2.257 |
| 500 | 0.5 | 5.180 | 0.895 | 0.842 | 4.338 | 83.7 | 19,000,000 | 5.700 | 0.125 | 0.018 | 5.682 |
| 500 | 1.0 | | 0.557 | 0.524 | 0.656 | 89.9 | 20,410,000 | 6.125 | 0.238 | 0.033 | 6.092 |
| 500 | 2.0 | | 0.350 | 0.329 | 4.851 | 93.6 | 21,260,000 | 6.380 | 0.341 | 0.048 | 6.332 |
| 500 | 3.0 | | 0.273 | 0.257 | 4.923 | 95.0 | 21,570,000 | 6.470 | 0.528 | 0.074 | 6.396 |
| 500 | 4.0 | | 0.229 | 0.215 | 4.965 | 95.8 | 21,750,000 | 6.525 | 0.851 | 0.119 | 6.406 |
| 500 | 5.0 | | 0.199 | 0.187 | 4.993 | 96.4 | 21,880,000 | 6.560 | 1.215 | 0.170 | 6.300 |

lines are in use only a small percentage of the time, the cheaper coverings have their advantages. Also there are places,

TABLE 3. CONDUCTIVITIES OF PIPE COVERINGS AT 300 DEGREES TEMPERATURE DIFFERENCE BETWEEN PIPE SURFACE AND ROOM.

| No. | Kind of Covering | Conductivity |
|---|---|---|
| I | J-M 85 per Cent Magnesia.... | 0.551 |
| II | J-M Indented..... | 0.686 |
| III | J-M Vitribestos..... | 1.087 |
| IV | J-M Eureka..... | 0.549 |
| V | J-M Molded Asbestos..... | 0.778 |
| VI | J-M Wool Felt..... | 0.521 |
| VII | Sall-Mo Expended Asbestos.. | 0.598 |
| VIII | Carey Carocel..... | 0.540 |
| IX | Carey Serrated..... | 0.682 |
| X | Carey Duplex..... | 0.636 |
| XI | Carey 85 Per Cent Magnesia.. | 0.546 |
| XII | Sall-Mo Wool Felt..... | 0.510 |
| XIII | Nonpareil High Pressure..... | 0.543 |
| XIV | J-M Asbestos Fire Felt..... | 1.093 |
| XV | J-M Asbestos Sponge Felted.. | 0.468 |
| XVI | J-M Asbestos Cell..... | 0.596 |
| XVII | J-M Air Cell..... | 0.718 |
| XVIII to XXII | Plastic 85 Per cent Magnesia. | 0.587 |
| XXIV | Sall-Mo Air Cell..... | 0.802 |

as on some heating systems, where the heat lost through the coverings is not piece of work. However, it is hoped that the data given in this paper will be of assistance to engineers in deciding upon the material to be used under certain conditions, and in calculating heat losses on installations already in use.

The durability of materials used for pipe coverings is a very important factor in determining the most economical covering for a given set of conditions. It has already been pointed out that the proper basis for comparing costs was the cost per year and not the first cost of the material. This is true because the covering giving the greatest length of service for a given first cost and efficiency is obviously the one to select. In general, fibrous coverings are more durable than the molded forms; since the latter tend to revert to their original powdered state due to vibration and rough usage.

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WITH "Winter Building" as a slogan, a campaign has been started to encourage building as an all-year-round proposition. The point is made that the dropping off of general building activity during the cold weather is due more to force of habit than to any more substantial cause. In support of this statement opinions have been obtained from architects and manufacturers of building material, indicating that the architects are as anxious for more winter building as the building supply manufacturers. A manufacturer of asbestos sheathing paper and of materials used in the installation of heating plants wrote that "without doubt an increase in winter building would give improved conditions to all material houses," and endorsed the proposal to influence the architects and builders toward a wider activity during the cold season.

Two manufacturers, while personally endorsing the plan, believed the old bug-a-boo, "there always has been a dull season and there always will be one," and added, "the opinion seems to be that the bulk of small building will be held up during the cold weather, however desirable it may be to extend it." The consensus of opinion, however, was to the effect that any manufacturer entering on such a campaign would benefit the architect and contractor, as well as the owner.

One of the most interesting points, from the standpoint of the heating engineer, is a statement regarding the effect of summer dampness on the interior woodwork of buildings. It was claimed, for instance, that the liability of the woodwork to shrink or swell in the winter time is far less than in summer, when the comparatively high moisture content of the air has the effect of swelling such woodwork, with the result that when the cold weather comes, accompanied by the lack of moisture in artificially heated air, it is a common experience to find such woodwork shrunken, resulting in the appearance of cracks and apertures which seriously affect the heating requirements. It is a fact that the "loosely constructed" building very often figures in the calculations of the heating engineer and it might be profitable to determine whether a house constructed in the winter time is any "tighter" than a similar one built in warm weather.

As one writer points out, the delays incident to the completion of a building in the winter, with its cold weather and storms, are unavoidable and this is a point that would have great weight in certain localities. But there are other sections, and they include portions of the country where the average winter temperature is well above the freezing point, as well as being busy business centers, where more winter building could be carried on to advantage, and in these sections the campaign may easily have important results.

# THE CONSULTING ENGINEER

*The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.*

CONDUCTED BY IRA N. EVANS, C. E.

**56—Points in Forced Hot Water Heating Work.**

QUESTION: I should esteem it a favor if you will inform me of the best book dealing with forced circulation hot water heating work. I would like to procure information on such details as (a) sizing and connecting up of cold feed to the apparatus, (b) necessity and positions for open vents, if any, and the height they should be carried above feed tank, (c) position, connections and relation of expansion tank to the apparatus and the feed tank. Such details are, of course, essential, but through the frictional resistances, etc., of the various circuits can be adequately dealt with from the information given in such books as Meier's "Mechanics of Heating and Ventilation," such details as (a), (b) and (c) are lacking. I should also like to obtain some information relative to the theory of the distribution of pressure when the pump is going, etc.

ANSWER: There is no book on this subject, although many devote small sections, stating it is merely a question of hydraulics and the determination of the friction and flow of water for a piping system between the radiators and heaters, pumps, boilers, etc.

The economies possible with the combination of hot water heating with condensing power units, whereby the heating system is utilized as a power plant adjunct to condense exhaust steam under partial vacuum, do not seem to be generally appreciated, or not to the extent of advocating many actual installations. It is possible to install condensing turbines and hot water heating in large plants, especially office buildings and hotels where 800 H.P. or more is required, and accomplish the following results:

RESULTS POSSIBLE WITH CONDENSING TURBINES.

(1) Utilize the exhaust steam without modifying the type of engine so as to reduce its economy in summer under full vacuum.

(2) Obtain the condensing effect of the heating system by taking advantage of the possible low temperatures of the heating medium in moderate weather, with lower cost of operation than with present methods.

(3) Regulate the temperature of the entire system by varying the vacuum from 0 in. to 26 in. or 27 in. to meet the weather changes from 0° to 60° F. outside, with the same efficiency as automatic temperature control on steam heating.

(4) The engine economy will be proportional to an average of 20 in. vacuum for that portion of the power required for the supply of exhaust steam for heating and 26 in. to 27 in. for the balance in winter and the entire power in summer, as against 0 to 5 lbs. back pressure for the entire year for all power where steam is employed.

(5) The water bill for the power, condensing with cooling tower or kindred apparatus, would be 15% less than where the surplus steam is exhausted to atmosphere under atmospheric pressure, due to the reduced steam rate in the engines.

(6) The cost of the combined hot water condensing plant, complete with turbines, cooling towers, etc., can be purchased for about the same cost as vacuum steam with large Corliss compound engines, arranged for non-condensing operation on an economical basis, and the same amount of radiation only is required for both systems.

These statements are all susceptible of proof and the condition applies to any plant with a capacity of 500 H.P. or more, and especially to large office buildings and hotels.

It is not possible, as a rule, to accomplish these results where the heating and power plants are designed independently; if large Corliss engines are installed, the cost is excessive, and, if steam heating is used, condensing operation does not pay.

It has been said that the water pressures in high buildings are dangerous, due to the liability of bursting and damage. At the same time, there are several large buildings 16 to 20 stories high heated by hot water and in successful operation. This is the same kind of argument as was formerly made against boilers with over 100 lbs. of steam some years ago.

There is no argument in the adoption of main with the flow of water, regardless of the grade.

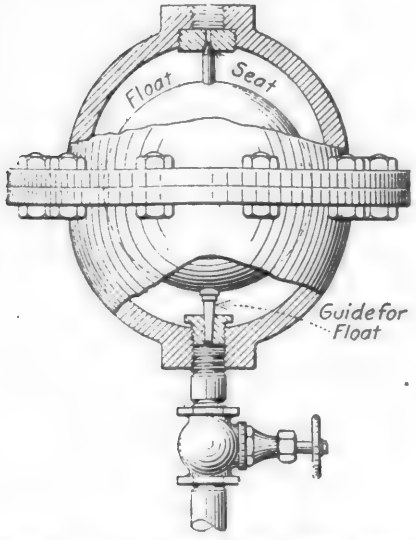


FIG. 1. AIR TRAP FOR USE WITH WATER HEATING SYSTEM.

water over steam on the score of more efficient heating, as the writer believes steam and vacuum systems are now designed that give just as good service from every standpoint of efficiency and economy, as hot water.

ADVANTAGES OF CONDENSING POWER AND HEATING PLANT.

The only reason for advocating this combination is the increased engine economy on the combined hot water heating condensing plant, due to the low terminal exhaust temperatures possible, which are impracticable with steam systems of any type.

The saving in fuel on a 2,000-H.P. installation of the hot water condensing type of power and heating plant is easily $10,000 per annum over the non-condensing steam plant, with an initial cost of the same amount for installation. The radiation on such a system is no greater in amount than for vacuum steam, as the same temperatures are maintained in zero weather, which is about 2% of the time.

It is of course admitted that this arrangement is not adapted to all plants, but at present the engine plant is modified and made more uneconomical permanently so as to utilize exhaust steam, while with the arrangement mentioned the most economical turbines may be used and the power plant is not modified in any respect to adapt the engines to the heating system. It is along the above lines that the author believes the greatest possibilities lie in the use of hot water heating by forced circulation. For many years this system was controlled by patents and for that reason the engineering profession generally opposed its introduction.

FEED WATER CONNECTIONS.

Regarding the specific queries raised by our correspondent, (a) the feed to a hot water system depends on the city pressure and need never be over 1 in. for the largest plant. The water lost from a heating system of this type should be a minimum. If the water in the system is changed to any extent, the contained air in solution in the new water will give trouble from air in the pipes and cause rapid deterioration, due to corrosion.

The cold water connection is generally made through an automatic water feeder to the expansion tank placed at the top of the system, as shown in Fig. 2. This arrangement requires a constant city pressure on the supply somewhat greater than the height of the system, plus the pressure at which the pop safety valve is set, so as to cause water to flow in at all times.

On large plants it is customary to make an auxiliary water connection of 1½-in. to 2-in. pipe for filling quickly by hand. In some cases, especially where the city pressure is light, the boiler feed or house pump is cross-connected with the heating system for this purpose.

(b) Air traps composed of a float and seat, as shown in Fig. 1, are placed on all high points and air pockets of the system. The discharge is connected to a sink or some place

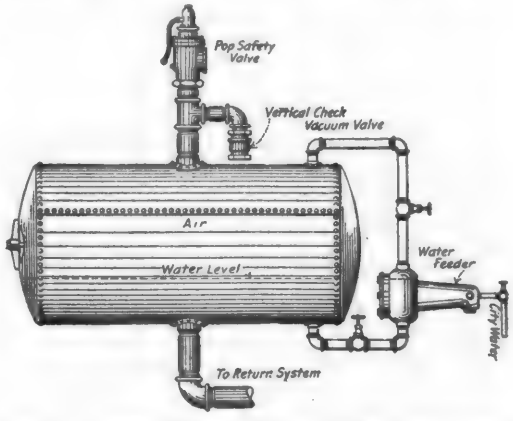


FIG. 2. EXPANSION TANK AND CONNECTIONS AT HIGH POINT.

where any slight drip will do no damage. A good steam drain trap turned upside down will serve the same purpose, so arranged that when the water raises the float it will close the opening.

In the use of a drain trap care must be taken that the type is such that the outlet is not submerged when the float opens, or a slug of water will be discharged each time the trap operates. All mains are graded up in the direction of the flow, never the reverse, as the pump drives the air to the end.

Air lines are not generally used, although there is no objection. They may be carried to the expansion tank but it is difficult and expensive to obtain clear runs from all points that will exhaust the air properly.

The air trap in Fig. 1 makes the best and most economical arrangement. It is presumed by the feed tank is meant the expansion tank.

ARRANGEMENT OF EXPANSION TANK.

(c) There are two general methods for the arrangement of the expansion tank on such a system. The one shown in Fig. 2, placed at the top of the system, and the one placed at the base of the system in the boiler or pump room under the direct charge of the operatives. Fig. 2 shows all necessary equipment as follows:

(1) Pop valve to maintain 5 lbs. to 10 lbs. above the static height of the system and prevent any excessive pressure on the apparatus. This should be a brass nickel seat valve of the very best type, from 2 in. to 3 in. in diameter, dependent on the size of the system. The overflow should be connected to a roof, or leader, so that the discharge will do no damage.

(2) The vacuum check valve should be 1¼ to 2 in. to prevent a vacuum being formed in the top of the tank and maintaining a false water level in the system that will interfere with the operation of the automatic water feeder. The automatic water feeder is intended to maintain the proper water level at all times in the system automatically. A 1-in. or ¾ in. city connection is all that is necessary. It should be connected as shown so as to equalize.

In the case of the tank placed at the base of the system, the air pressure must be sufficient to overcome the height of the system, plus the pressure at which the pop valve is set. The tank is connected to the return of the pump in both cases with a 2-in. or 2½-in. pipe, depending on the size of the plant. The air pressure is generally provided for other purposes at 100 lbs., which is sufficient. Sometimes a separate Westinghouse air brake pump is utilized for this purpose.

METHOD OF OPERATION.

Following is the method of operation to determine the proper height of the system with the pressure or altitude gauges, and when the pressure is below this point the system needs water. The air pressure valve is opened and the water forced out of the tank into the system.

Air traps, as in Fig. 1 at the high point, relieve the system of any air when requiring water. If the water level in the tank is too low, water is admitted. It is customary, as the tank is placed under the direct charge of the operatives of the plant, not to make these automatic, but to operate them by hand as water is required. The size of the tank in both cases can be determined by the known range in temperature of the water in the system by the cubic feet or number of gallons. The tank should be provided with water gauges of sufficient length so that the water will appear at all times, regardless of the temperature and without producing sufficient additional pressure between the maximum or minimum temperature to open the pop safety valve. Of course, this means a closed system, but the advantage of some pressure at all points is considerable in improving the circulation.

The difficulty of the pumping head being less than the friction head at any point in the system can be overcome by this arrangement.

The tank should be of such a size and capacity that with the complete temperature range in the water the tank will show from one-fourth to one-third full of water. It is readily seen that if the tank is too small the pressure will be too great at the maximum temperature, causing a loss of water through the pop valve.

It is also seen that the pressure at which the pop valve is set determines the maximum temperature of water at which the apparatus may be operated. If set at 5 lbs. over the static head, 215° outboard may be carried. If set at 25 lbs., the water may be operated at a temperature corresponding to steam at a somewhat lower pressure, say 20 lbs., or about 260° F.

Where exhaust steam is utilized under vacuum, the radiation should be so arranged that any temperature over 215° will be unnecessary.

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**57—Data for Figuring an Indoor Plunge.**

QUESTION: Kindly advise me as to what firm or firms can give me the necessary information and apparatus for the installation of an indoor plunge? I wish to heat city main water and filter and reheat the overflow. The tank to be installed will be 35 x 75 ft., with a depth of 3 to 6½ ft. We will expect to raise the temperature from 40° to 80° F. in from 5 to 6 hours. We would also like to know of the most economical filter of sufficient capacity to handle this 12,469 cu. ft. of water every three days. Owing to the high price of our city water, it will be necessary for us to figure re-using the water, providing it can be filtered to a fair degree of purity. We also intend to clean out the pool and to refill it once a week. We should like to know the best means of heating this body of water, whether to use coils, steam jets or steam heaters.

ANSWER: As regards filtering the water, it would require another receptacle of the same size to completely empty the pool in

order to purify it by means of a filter. This would mean a 95,000-gal. tank in addition. Filtering a portion of the water by recirculation would not be efficient, and in any case there would be possible products in solution that would pass through any filter unless chemically treated in the passage through such filter.

Regarding the heating of the water, it would make little difference how it is accomplished as it will require the following power:

12,469 cu. ft. x 62½ = 779,312 lbs.

If accomplished in 5½ hrs. from 40° to 80° F., it will require a boiler of the following horsepower:

$$\frac{779{,}312 \times 40}{5.5} = 5{,}667{,}730 \text{ B.T.U. per hour.}$$

$$\frac{5{,}667{,}730}{34.5 \times 1{,}000} = 164.3 \text{ boiler horsepower.}$$

It is readily seen that this is rather an excessive investment for equipment, but if these are the requirements to be met it will take the power stated. If you take 903.65-H.P. capacity for one hour and divide by the time, you can readily determine how large a plant you need to install.

The following are manufacturers of water filters: Loomis-Manning Filter Distributing Co., 1 Madison Avenue, New York; Jas. Beggs & Co., 36 Warren Street, New York; Ross Valve Mfg. Co., Troy, N. Y.

If a separate tank is provided to hold the water to be refiltered, and if the heater and tank are placed on a higher level than the bottom of the pool, it would be best to use an electric-driven pump to raise the water from the plunge to the storage tank and for circulation through the heater. If no pump is used, the heater will have to be placed below the level of the plunge to obtain circulation by gravity.

If steam were available from other sources, a heater could be used with fairly high pressure steam, so arranged that the shell could be placed on a level with the bottom of the pool in a pit and the water recirculated through a shell with the steam in the coil. This would require a smaller pit to be built than if you were providing for firing a boiler. If a steam pressure is available of 10 or 15 lbs., the condensation can be raised out of the pit.

The simplest method would be to place a hot water boiler on a level with the bottom of the pool or below and connect the circulating pipes from the bottom and top. Another method is to inject steam directly into the pool, allowing the condensation to mingle with the water.

In any case, the power required will be as given for the stated time. If the period of heating up is lengthened, the power will be reduced accordingly.

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**58—Water Troubles in Steam Radiators.**

QUESTION: We have rather a perplexing problem here in the way of a steam plant upon which we would like to have a little advice. The boiler is high pressure. The main is taken out of the top of the boiler (vertical type) and is 1½-in. in diameter. This runs along the ceiling from which four radiators are tapped, using 1¼-in. pipes. The return for the condensation is 1¼-in.

All these radiators fill up with water as soon as the steam goes up in the boiler and when it comes down, the water comes back. The upstairs radiators do not fill with water, and they heat all right. The lower radiators are 14 in. higher than the water level. The fact that the water runs back when the pressure is low is an indication, not that the radiators are too low, but that the lead or outlet is too small and allows too much pressure on the water? Is this right and would a 3-in. pipe or a 2½-in. lead pipe obviate this trouble?

ANSWER: You have stated the difficulty exactly. Where radiators are as close to the water line as stated and any distance away, it is almost impossible to keep them clear of water with more than 2 or 3 lbs. on the boiler. It requires a column of water equal to the difference between the pressure in the radiator and that in the boiler, figured at 0.43 lbs. per foot of height.

It must, of course, be rembered that as the pressure is raised on the boiler this difference in height becomes greater and the increased temperature also causes more condensation or heat emission from the radiator. If the boiler can be operated on a low pressure of 2 or 3 lbs., the supply and amount of radiation may be increased, if not sufficient to do the heating. If the boiler has to be operated on high pressure for other purposes, the most economical method of returning the water is to disconnect the return of the radiator within 14 in. of the water line of the boiler and connect a return trap. This return trap is placed slightly above the water line of the boiler and arranged so that by a dumping movement of the trap, steam is connected directly to the trap, supplying boiler pressure sufficient to cause the water to flow back to the boiler.

While dumping, a check in the main return shuts off the heating system. After the trap dumps, it automatically shuts off the boiler steam and the steam in the trap condenses, allowing the check on the return to open and fill the trap. The operation is then repeated.

The only caution to be taken is to have a separate steam connection between the trap

and the boiler, full size called for by the manufacturer, so as to be sure and obtain the full boiler pressure on top of the water in the trap.

If anything else is taken off the line, the pressure is apt to be reduced, causing the trap to stop operating.

# LEGAL DECISIONS

**Heating Rates—Factors to Be Considered.**

A utility filed with the Illinois Public Utility Commission, a schedule of charges for heating water tanks by a steam coil, this charge to be in addition to the regular building heating rates. The city filed a complaint, alleging that the rates were excessive and unreasonable. The facts of the case were as follows:

The company supplied steam-heating service from a central station, and the charge for this service was determined by the kind and size of building heated. The schedule of rates as originally filed did not include a charge for heating hot-water tanks. The rate that the company wished to put into effect was as follows:

30-gallon tank.....$15 per heating season
42 " " ..... 20 " " "
60 " " ..... 30 " " "

The city submitted evidence to show (1) the amount of water consumed by the six consumers having hot water tanks; (2) the amount of radiating surface in the heating coil of the tank; and (3) the amount of radiating surface of the tank. Taking either the square feet ot heating surface in the coil or the square feet of radiating surface of the tank as a basis, the city found that the approximate charge for the heating season would be $1 or $1.75 for each tank, depending on the basis used. The company submitted an exhibit wherein the amount of hot water used by the average family was assumed, and on this basis the additional expense to the company caused by the installation of one of these tanks was computed. By this method a cost to the company of $17.06 was arrived at without making allowance for taxes, insurance, interest, etc.

The Commission held that the method adopted by the city in arriving at a rate was based on the erroneous assumption that a square foot of heating surface in air gives off as much heat as a square foot of heating surface in water, and did not take into consideration many of the important factors. The method used by the company was predicated on a more correct basis, but it was subject to the criticism that many assumptions were necessary to complete the computations. Of the two, the method used by the company was held far more acceptable. Any change computed in advance must of necessity be based on assumptions, and those used by the company appeared to be fairly reasonable. The schedule was therefore approved.—City of Taylorville vs. Central Illinois Public Service Co., Illinois Public Utilities Commission.

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**Infringement of Furnace Regulator Patent —Preliminary Injunction.**

Suit was brought for infringement of patents Nos. 817,438 and 826,349 for method of regulation of furnaces. Suit had previously been brought against the Hotel Astor, New York, which was the user of a particular furnace regulator, which it was alleged infringed the patents. That suit was defended by the defendant in the present suit, which makes devices which the complainant contends infringe its patent. In the suit again the Hotel Astor infringement was found. In the present suit the defendant denied that it was offering the same system and apparatus as the complainant's, but admitted that it was the defendant which installed the apparatus in the Hotel Astor. That being so, it was held to be within the discretion of the court to grant a preliminary injunction. If the defendant's regulators did not infringe, the injunction did not cover them.—Engineer Co. vs. Blaisdell Canady Co., C. C. A., 220 Fed. 673.

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**Ventilation of Street Cars.**

Chicago Code 1911, Sec. 2210, requires street cars to be so ventilated that the carbonic acid present in the air therein shall not exceed 10 parts in each 10,000 parts of air. In a prosecution for a violation of the ordinance the evidence showed that there was another ventilating system in use in Chicago on cars operated by others than the defendant, whereby the requirements of the ordinance were complied with. A finding of not guilty by the trial court was, on appeal, held evidently to have been based on the theory that the violation was not intentional and that the defendant had done its best to comply with the ordinance.—Chicago vs. Chicago City Ry. Co., 192 Ill. App. 1.

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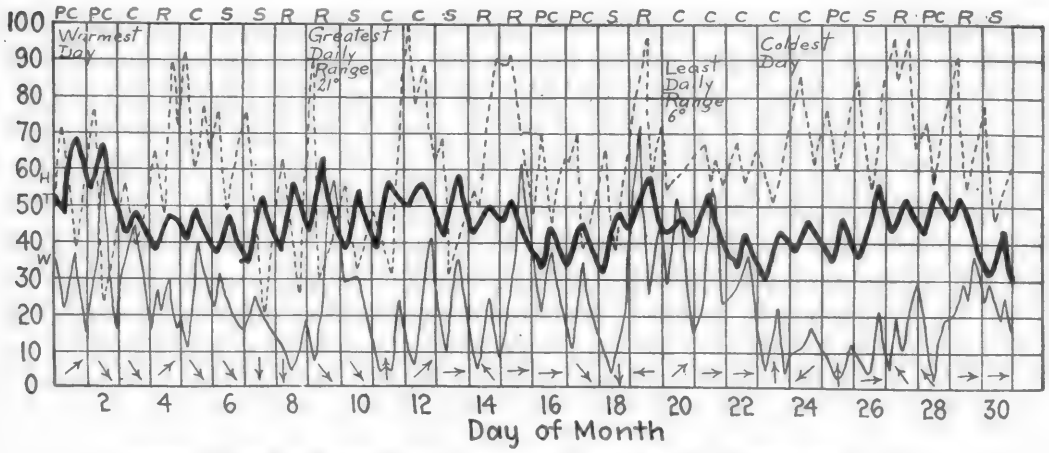
**Current Heating and Ventilating Literature.**

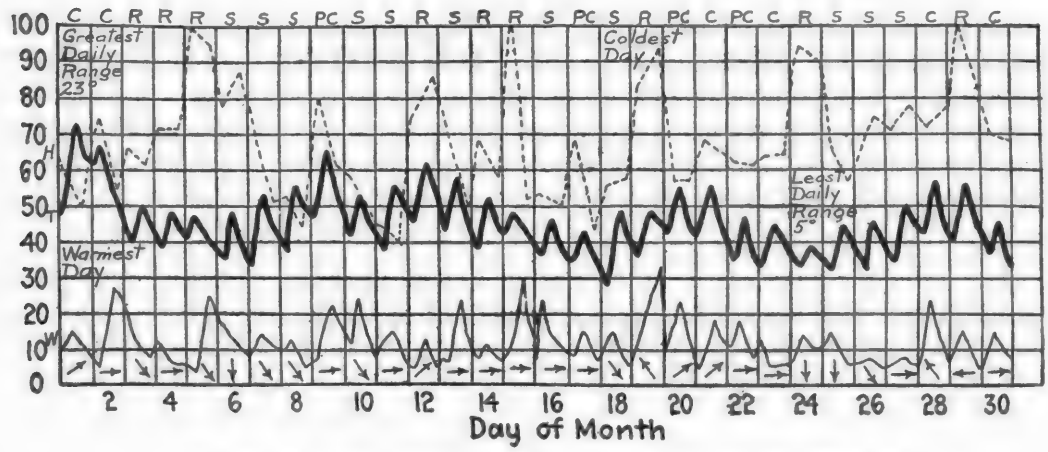
Underground Heating. Design, construction and operation of systems from central plant. 1,200 w. Prac. Engr., Chicago—Oct. 1, 1915. 20c.

## The Weather for November, 1915.

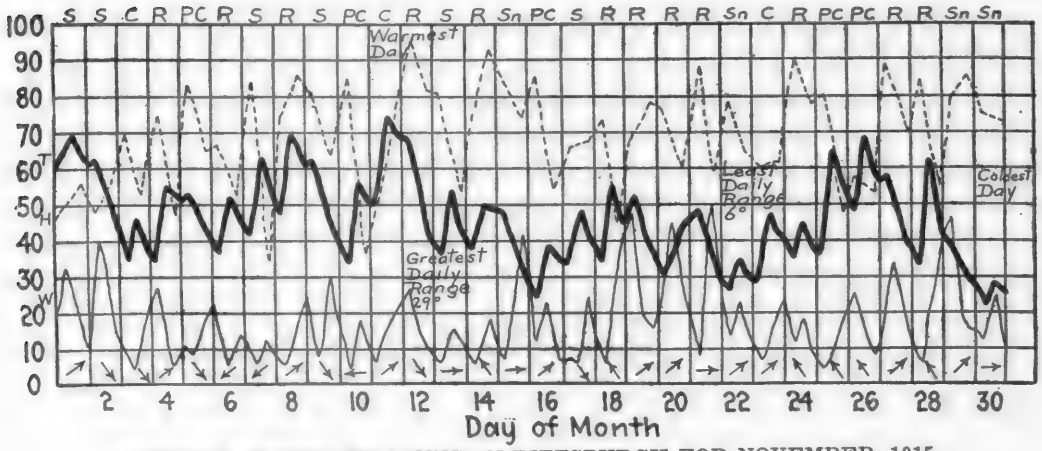
| | New York. | Boston. | Pittsburgh. | Chicago. | St. Louis. |
|---|---|---|---|---|---|
| Highest temperature, degrees F. | 68 | 72 | 74 | 75 | 81 |
| Date of highest temperature | 1st | 1st | 11th | 7th | 6th |
| Lowest temperature, degrees F. | 30 | 29 | 22 | 23 | 23 |
| Date of lowest temperature | 23d | 18th | 30th | 30th | 15th |
| Greatest daily range, degrees F. | 21 | 23 | 29 | 26 | 34 |
| Date of greatest daily range | 9th | 1st | 12th | 11th | 20th |
| Lowest daily range, degrees F. | 6 | 5 | 6 | 2 | 7 |
| Date of lowest daily range | 20th | 24th | 22d | 15th | 19th |
| Normal temperature for month, degrees F. | 45.4 | 45 | 45 | 44.2 | 50.9 |
| Normal mean temperature for month, deg. F. | 44 | 41.2 | 42.9 | 39.2 | 43.4 |
| Total rainfall, inches | 1.09 | 2.14 | 2.37 | 2.03 | 1.97 |
| Total snowfall, inches | Trace | 0.2 | 0.4 | 0.7 | Trace |
| Normal precipitation this month, inches | 3.44 | 4.1 | 2.55 | 2.5 | 2.88 |
| Total wind movement, miles | 13,915 | 8,046 | 9,468 | 10,720 | 11,811 |
| Average hourly wind velocity, miles | 19.3 | 11.2 | 13.2 | 14.9 | 16.4 |
| Prevailing direction of wind | N.W. | W. | S.W. | W. | S. |
| Number of clear days | 7 | 13 | 8 | 9 | 11 |
| Number of partly cloudy days | 9 | 5 | 7 | 10 | 10 |
| Number of cloudy days | 14 | 12 | 15 | 11 | 9 |
| Number of days on which rain fell | 9 | 9 | 16 | 12 | 6 |
| Number of days on which snow fell | .. | 1 | 4 | 3 | .. |
| Snow on ground at end of month, inches | .. | .. | Trace | Trace | .. |




RECORD OF THE WEATHER IN NEW YORK FOR NOVEMBER, 1915.
(Hourly Observations of the Relative Humidity Are Recorded on this Chart.)




RECORD OF THE WEATHER IN BOSTON FOR NOVEMBER, 1915.


S S C R PC R S R S PC C R S R Sn PC S R R R R Sn C R PC PC R R Sn Sn
Warmest Day
Least Daily Range 6°
Coldest Day
Greatest Daily Range 29°
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H
W
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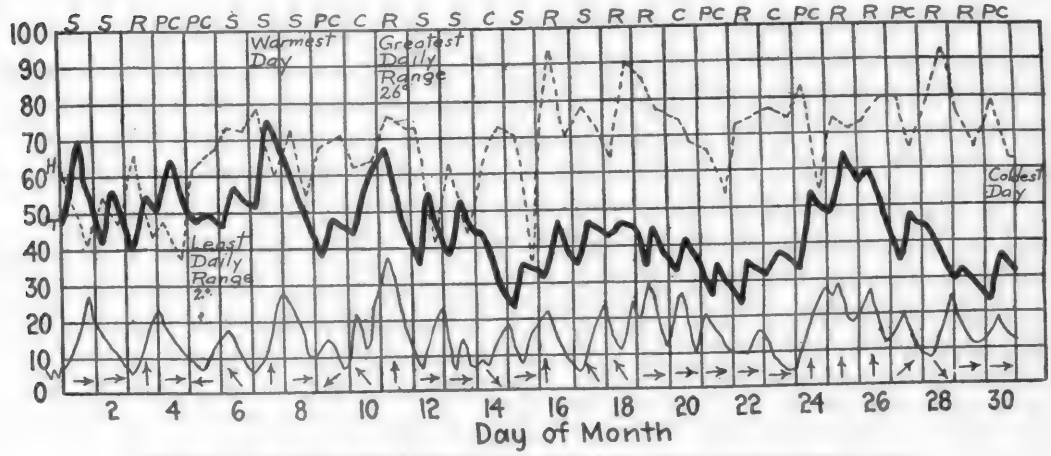
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR NOVEMBER, 1915.


S S R PC PC S S S PC C R S S C S R S R R C PC R C PC R R PC R R PC
Warmest Day
Greatest Daily Range 26°
Coldest Day
Least Daily Range 2°
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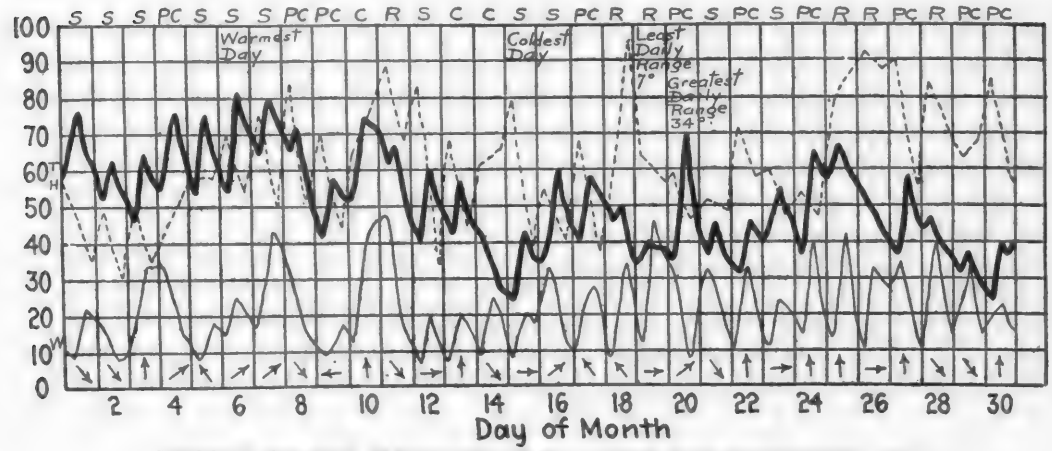
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR NOVEMBER, 1915.


S S S PC S S S PC PC C R S C C S S PC R R PC S PC S PC R R PC R PC PC
Warmest Day
Coldest Day
Least Daily Range 7°
Greatest Daily Range 34°
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100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR NOVEMBER, 1915 .

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

## New York Chapter Discusses Vapor and Vacuum Heating Systems

Vacuum and vapor heating systems came in for a lengthy discussion at the December meeting of the New York Chapter, which was held December 13 at the Engineering Societies' Building. The principal speakers were T. F. Hynes, of the Bishop-Babcock-Becker Co., and James A. Donnelly, of the Positive Differential System Co. Others who took part in the discussion were A. M. Feldman, President A. J. Driscoll and Secretary F. K. Davis.

Mr. Hynes, the first speaker, began his remarks by referring to the matter of comparative efficiency of various heating systems.

GRAVITY STEAM HEATING TYPE PLANTS VS. VAPOR.

In the one-pipe gravity plant, he said, it is usually necessary to tax the boiler with the lessened efficiency due to a back-flow of condensation against steam travel. Pressure must be carried at all times to insure circulation. The restricted venting devices ordinarily used air-bind the system, and cold sections prevent full efficiency. There is very little variation in temperature to adapt to mild, moderate or extreme weather conditions. The intense firing necessary creates clinkers, and results in flue gas wastage. High temperatures strain connections to radiation and in the pipe and fittings. The one-pipe job is sluggish and it is characterized by a fickle boiler water line, resulting in lessened boiler life and the destruction of fullest efficiency by drops in temperature and pressure in the steam supply to the radiation.

In two-pipe gravity jobs the losses from the venting devices in drip and evaporation occur as in the one-pipe gravity system. This results in escape of obnoxious odors and creates an undesirable humidity in the room's atmosphere. There is very little flexibility and pure wastage results from resort to outside ventilation to overcome a superheated condition in moderate weather and in the milder climates.

HOT WATER VS. VAPOR HEATING.

Hot water plants are adapted in size to match those in which vapor systems are usually installed. The hot water plant is not desirable for severe climates, or where there is much glass surface or leakages to contend with, on account of the low temperature efficiency, which is not comparable to vapor or steam to meet the requirements of the modern industrial plant or commercial building where the highest labor efficiency is dependent on adequate heating for comfort. In many installations the sluggish hot water system, especially where intermittent heating is necessary, only gives the highest efficiency after the need of heat is over with increasing warmth of the day. There are five to eight times the hot water volume to heat that there is on a vapor job and the retention of the temperature when this large quantity of water is heated wastes fuel and labor when heat is not desired. Valved-off units suddenly put into service interfere with the efficiency of the entire plant. Hot water heating is not retaining its one time popularity, said Mr. Hynes, the greater economy, flexibility and efficiency of vapor system relegating it into the background.

OTHER ADVANTAGES OF VAPOR HEATING.

The vapor method of heating is adapted for small or medium-sized heating jobs where mechanical vacuum operation would, by reason of first cost, prove prohibitive. This method may also be used advantageously in the largest buildings where the condensation is wasted, or where a gravity return to boiler is procurable. In the larger heating jobs, whether operated on low-pressure boilers or run-off exhaust or live steam, it is our opinion that an automatically controlled vacuum pump is more desirable than a vapor installation. Vapor heating is based on the principle of securing slight initial pressure-checking, condensing steam or vapor, and holding a vacuum by sealing against atmosphere.

The vapor system of heating is distinguished by its great flexibility in individual radiator control, its convenience, quick and silent result, economy, and the added slight increase in first cost being justified by these advantages over straight gravity or hot water types of heating plants.

It is the practice of the Bishop-Babcock-Becker Company to use a packless graduated valve, quick-opening with quarter turn, self-cleaning, and requiring no adjustments for various sizes of heating units. At the return end of radiator a thermostatic trap is installed to vent, relieve condensation and trap the steam in the heating unit. Pressure does not

extend to the return lines, and no delicate adjustments are necessary on the supply end. It is the company's opinion that under the varying conditions in a heating plant it is not feasible to make a permanent modulating valve adjustment which will give uniform and good service in supplying the exact amount of steam which a radiator will condense. The company rates the radiation under ordinary conditions about 10% in excess of gravity rating, and the boiler about 20% in excess of straight gravity. This means reasonable first cost, and has been demonstrated sufficient. The end of supply main is freely vented with a thermostatic vacu-check valve, which prevents steam escaping, and the check prevents air being forced into the ends of supply mains from the dry return.

A vacu-vapor vent valve of large capacity allows free venting at ends of dry return circuits and from the supply main and seals against atmosphere, at the same time retaining the vacuum created in the system by condensing.

If accidental pressure is attained and condensation backs up in the vent lines, a static head overcomes the boiler pressure, and the condensation flows by gravity through a balanced or swing check valve back to the boiler. A sensitive and positive damper regulator is used. Reasonable first cost, simplicity, economy and efficiency characterize this system in actual service. The satisfaction of the users and of the heating engineers with the vapor type heating plant is proven by the greater increase over all others in the numbers of vapor installations being made in recent years, and like progress is seemingly assured for the future.

In discussing some of the points brought up by Mr. Hynes, Secretary F. K. Davis said that the statement regarding the comparative lower efficiency of hot water heating in large buildings does not seem to be what we might expect, in view of the large plants equipped with forced hot water heating systems. In many of these plants, he said, the water is hotter than steam would be in a vapor or vacuum heating job, as the temperature of the water is often at 240° F., while steam would seldom be above 214°. Mr. Davis also called attention to the fact that vapor heating has been applied in very large buildings, containing, in some cases, as much as 60,000 sq. ft. of radiation.

### CAUSE OF HIGH VACUUMS.

Speaking of high vacuums, Mr. Davis believed that in vapor systems these were due to large returns. The return mains are usually left uncovered and present large cooling surfaces. There are some systems that use several sections of radiation to condense the vapor in the returns.

James A. Donnelly stated that there is a decided advantage in a system that allows the heating of units to be increased or decreased to meet the desires of various people. Especially is this true in the heating of houses where there may be children, or sickness, in which case much more heat might be necessary in one portion of the house than in another.

### EXPULSION OF AIR ESSENTIAL.

Concerning a vacuum on a gravity job, Mr. Donnelly said it was always essential to expel all the air from the system as completely as possible when the plant is first started, in order to get a reasonable vacuum. Thermostatic valves on the outlets of radiators, in Mr. Donnelly's opinion, offer but negative results, as they leave all the air in the return between the outlet of the radiator and the water line of the boiler. The previous speaker mentioned as a cause of vacuum in vapor work, the contraction of the air in the return line as it cooled. The expansion of air under a vacuum, said Mr. Donnelly, would be many times greater than its contraction, due to a decreased temperature. Some years ago, Mr. Hoffman brought up the question as to why cold spots developed in sections of vacuum systems. The explanation was that with complete circulation through the steam and return mains, it could hardly be expected that more than 90% of the air would be removed. If 10% of the air is left in, and we drop the pressure to 20 in. of vacuum, we will then have 30% of air in the system. According to tests, it has been found that the air collects one time at one portion and another time at another portion of the system.

Mr. Donnelly referred to a paper he had presented at a meeting of the National District Heating Association, giving a comparison of operating conditions and the amounts of vacuum that it is necessary to maintain in order not to overheat a building. The amount of vacuum necessary for this purpose increases very rapidly for a comparatively slight rise in the outside temperature. A vacuum of 18 in., for instance, becomes necessary when the outside temperature is 25° above zero, if the radiation is sufficient to heat the building at atmosphere in zero weather. Thus, it would be very difficult to keep from overheating the building by this method alone and it is considered much better practice to control the heating effect of a radiator by heating a portion of it by means of a fractional system, than to attempt to heat all of the radiator but to reduce its temperature in relation to the outside tempera-

ture by carrying a varying vacuum within it.

The manufacturers of vacuum air valves, added Mr. Donnelly, have never designed and placed on the market a damper regulator for maintaining the pressure in the boiler at any particular degree of vacuum. The usual practice is to bank the fire and drop to as low a vacuum as possible. Then the house gradually becomes cold, instead of being maintained at the proper temperature.

EXHIBIT OF OLD-STYLE VACUUM VALVES.

At this point, President Driscoll announced that Mr. Donnelly had brought to the meeting a number of old-style vacuum valves, including the original vacuum system valve, which could be inspected by all present. Mr. Donnelly said that he began collecting these valves some years ago. He said he was ready to present the collection, through the New York Chapter, to any college, to be preserved, similar to the historic collection of incandescent lamps of all makes.

Speaking broadly on the subject of the evening, Mr. Donnelly said:

REVIEW OF VACUUM HEATING PRACTICE.

"I have had experience with a number of systems, beginning with the Williames system, about 25 years ago. Later I put in some of the first Paul air line systems, at the time the system was introduced in Boston. A year or so after this I put in some of the first plants which used the rubber thermostatic valve. This type lasted for some time, from about 1894 to 1901. It was succeeded by the pressure motor type, one design being of my patent, the other being introduced by Messrs. Paul and Kinealy.

"After these came the float valves, in many types and sizes. The vaporized fluid valve succeeded these. The first use of vaporizing fluid valves, applied to each individual radiator, was as a vapor or air-return system, with open vent returns. They had been tried experimentally some years before by the company which controlled the use of the rubber thermostatic valve, but it was stated by them that they were only good for one pressure and temperature; that any increase in the pressure would cause them to hold up water, and any decrease in the pressure would allow them to blow steam. I believe that the successful introduction of the Dunham valve for vacuum return line systems has shown that this difficulty may be overcome.

"The first use of fractional or modulating valves on the inlet of the radiator was an attempt to control not only the partial heating of the radiator, but the total steam admitted, restricting the maximum opening of the valve to that required for the total heating of the radiator. I believe it is now considered much better practice to make the maximum opening of the fractional valve large enough to heat the radiator very quickly, and to use some form of automatic appliance to prevent or restrict to the proper amount the flow of steam to the returns.

VAPORIZING FLUID VALVES.

"The many interesting designs of vaporizing fluid valves that are now in use are capable of furnishing material for some varied discussion. Broadly speaking, there are two large classes: those having the vaporizing fluid on the inlet, that is, between the radiator and the valve seat; and those having the vaporizing fluid on the outlet, that is, beyond the valve seat. Though both types of valve have a certain range in temperature through which they may operate very well, there must be one particular temperature and pressure at which each will operate best. This might be called the temperature for which they are designed. Those having the container on the inlet would, therefore, work best where a constant and uniform steam pressure was maintained in all the radiators, while those with the container, beyond the valve seat, where a constant and uniform vacuum was maintained at the outlet of all the radiators.

"Therefore, if the steam pressure varied in different buildings or in different portions of the plant, it might be well to vary somewhat the valves that were used. Likewise, if the amount of vacuum varied in different parts of the return system, it would be necessary to have the containers holding the vaporizing fluid vary in the same way that the vacuum carried varies. Some of these valves are made with a means of adjustment so that the action of the valves may be modified to a certain extent, and it might be a profitable topic for discussion as to whether or not all valves should be provided with means for adjustment.

PIPE SIZES MUST BE AMPLE.

"When vacuum return line systems were first introduced, the sizes of both the steam and return pipes were made very small. It has been interesting to follow the changes that have since been made in them in bringing them back to a more conservative standard. Many of the early systems had vacuums as high as 20 in. to 23 in. at the pump, produced by a liberal use of jet water, although the return pipes were so

small that this vacuum frequently dropped to 3 or 4 in. at points 1,200 to 1,500 ft. from the pump. In like manner, with a steam pressure of ½ lb. to 1 lb. at the source of supply, the friction of the flow would be so great that 2 in. of vacuum would often be found in the steam main at the extreme end of the line.

"When piston and float valves were first introduced, it was found that they must be made to operate very easily and practically without friction, so that the low difference in pressure at the extreme end of the system would operate them. Therefore, when they were subjected to the high difference in pressure near the pump, they operated very quickly and were very noisy. This caused a considerable increase in the size of the return lines, so that even with jet water, it was not possible to get more than 6 in. or 8 in. of vacuum at the pump, but this vacuum would extend to the farthest point of the main return line practically without drop. In this manner, a lower and more uniform difference in pressure was maintained, which improved the action of the apparatus very much.

"It has been found that with vaporizing fluid or thermostatic valves, it is commercially better engineering practice to use smaller returns. Where this is done, in case some of the containers crack or leak, or are held open by dirt in the seat, allowing steam to be admitted to the returns in considerable quantities, it is possible to maintain a very much higher vacuum by the use of jet water than if the return piping is large.

"I think it will be conceded that where a plant is continuously operated and where radiators are not closed off or turned on, an orifice at the outlet of each radiator, such as was originally used in the Williames system, provided it will not be stopped up with dirt, will produce perfect circulation. It is only necessary to proportion the orifice for two things: the size of the radiator and the distance from the source of supply. Automatic valves of float or thermostatic type, where the plant is in continuous operation, would also maintain an average orifice of the same size as the first described. In plants where check valves, with restricted seats, are used at the outlet of all radiators, in combination with a similar valve in each branch return, the proper adjustment of these valves produces a combined effect exactly parallel to the previous methods described.

"In claiming many new points of superiority for the vapor system, we should not lose sight of the fact that the old gravity system had some good features also. One of the good points of the gravity system is that it can be operated at any pressure with a very simple damper regulator, and that it does not require special apparatus at the boiler for the purpose of returning the water of condensation. I believe, however, that the modern vapor system, which can operate at any pressure, is certainly superior to one which can only be operated at an extremely low steam pressure.

"Quite recently I stated to an architect that a good one-pipe system would cost more than a fractional vapor system. A good one-pipe system should have two radiators in a room, while a vapor system, with fractional control, needs only one. The air valves of a one-pipe system should be piped to the cellar in order to eliminate the many annoyances which they cause. A comparison of competitive figures on this basis will show that a vapor system may be installed more cheaply than a first-class one-pipe system."

In connection with the plans of the chapter's entertainment committee, it was announced that the annual dinner of the society would be held this year at the Hotel Astor. The New York Chapter, the society and President D. D. Kimball have each appropriated $100.00 to the entertainment fund, so that there will be no popular subscription to the fund this year.

The proposed amendment to the chapter's constitution regarding the method of electing members was adopted.

It was voted to refer to the society a report that had been prepared by a chapter committee recommending changes in the society's constitution.

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### Illinois Chapter Hears Address on the Use of Gas for Heating Purposes.

A timely address on the utility of gas for heating and for industrial work was presented at the December meeting of the Illinois Chapter by Frank F. Cauley, manager of the industrial appliance division of the People's Gas Light & Coke Co. of Chicago. The meeting was held at the Morrison Hotel, Chicago, December 13. Mr. Cauley's talk was illustrated by stereopticon slides showing, among other things, the use of gas as a fuel for steam boilers, ranging from 3 to 20 H.P.

Although the address was largely devoted to the industrial uses of gas in metal melting furnaces, etc., there was much to interest the heating engineer in view of the possible use of gas heat for warming purposes during the milder winter weather. One of the interesting statements made by Mr. Cauley was that his company is now at work on a sliding scale of rates for gas used for heating purposes, in-

dicating that there might be some reduction of the gas rates in Chicago.

In connection with the business session of the chapter a committee, consisting of E. J. Claffey, G. I. Cook and J. H. Davis, was appointed to secure a large attendance from Illinois at the annual meeting of the society in New York, January 18-20.

### Massachusetts Chapter.

Andrew G. Paul was the principal speaker at the December meeting of the Massachusetts Chapter, held at the American House, Boston, December 14. Mr. Paul, who has recovered from a recent illness, had found time to invent and perfect a number of heating specialties and he gave the chapter an interesting talk on the construction and application of these specialties. The meeting was preceded by a chapter dinner and, in the absence of President E. N. Stone, was presided over by F. S. Boltz.

A special committee was appointed to secure as large an attendance as possible at the society's annual meeting in January. It was announced that the January meeting of the chapter will be held in New York in connection with the society's meeting.

### Arrangements for Annual Meeting.

A program that will fill every available minute has been arranged for the annual meeting of the American Society of Heating and Ventilating Engineers, to be held in New York, January 18-20. The sessions will be held as usual in the Engineering Societies Building, 29 West 39th street, and the society dinner, on the evening of January 19, will be held at the Hotel Astor.

The papers and reports scheduled to date include the following:

"Tests on the Recirculation of Washed Air," by G. L. Larson.

"Heating and Ventilating Plant, Waite High School, Toledo, Ohio," by Samuel R. Lewis.

Report on the establishment of standard heating elements for cooking apparatus, with special reference to low pressure steam, by D. S. Boyden.

Report on the establishment of a standard co-efficient for heat losses affected by wind movement, by H. W. Whitten and R. C. March.

(The two foregoing reports were part of a report of a joint educational committee of the heating engineers' society and the National District Heating Association, and were presented at the annual meeting of the latter association in Chicago last June.)

"Cost of Opening Streets for Pipe Trenches," by W. F. Verner.

"Heating Industrial Plants," by J. F. Cyphers.

"Office Building Operating Costs," by George W. Martin.

"Air Leakage Through Windows," by Henry C. Meyer, Jr.

"Transmission of Heat in Warm Air Furnaces," by John R. Allen.

"The Testing Institute at Berlin, Germany," by Arthur K. Ohmes.

"Heating of the Commonwealth Edison Building, Chicago," by S. Morgan Bushnell, being a description of the plant and tabulation of operating costs.

"Heating and Ventilating Plant for the Equitable Building, New York," by W. H. Driscoll.

"Report on the Work of the New York State Ventilation Commission," by George C. Palmer.

"Ventilation of Homes," by the Chicago Ventilation Commission.

"Can We Standardize the Requirements of Ventilation," by J. J. Blackmore.

The papers and reports here given will all be presented at the meeting, but not in the same order.

The entertainment committee of the New York Chapter, headed by J. I. Lyle, will have many delightful treats in store for the ladies, as well as for the members themselves.

### American Society of Mechanical Engineers.

An attendance of 1370 members and guests was registered at the thirty-sixth annual meeting of the American Society of Mechanical Engineers, held in New York, December 7-10. Among the papers of special interest to heating engineers were the following:

"Heating by Forced Circulation of Hot Water in Textile Mills," by Albert G. Duncan.

"The Heat Insulating Properties of Commercial Steam Pipe Coverings," by L. B. McMillan.

"Proportioning Chimneys on a Gas Basis," by A. L. Menzin.

D. S. Jacobus, of New York, was elected president of the society, succeeding John A. Brashear. The new vice-presidents are William B. Jackson, Chicago; J. Sellers Bancroft, Philadelphia, and Julian Kennedy, Pittsburgh; managers: John H. Barr, New York; John A. Stevens, Lowell, Mass., and H. de B. Parsons, New York; treasurer, William H. Wiley, New York.

The society has issued a new edition of the boiler code which contains a comprehensive index. The index is divided into two parts, one a general index to the complete rules and the other containing sectional indexes to the

parts referring to new installations of power boilers, new installations of heating boilers, and existing installations.

A proposal made by the publication committee to make the society's "Journal" a semi-monthly or a weekly, instead of a monthly publication, was indorsed by the council, to take effect as soon as the amount of matter to be handled requires it and the funds for that purpose are available.

### Trade Commission Extending Export Inquiry.

The Federal Trade Commission announces that it will soon send out 30,000 letters of inquiry, followed up by a brief schedule, as a part of the investigation of conditions that affect American foreign trade. Congress has empowered the commission to make an investigation of these conditions and to report the facts with such recommendations as it deems advisable.

An interesting item of news in this connection is that more than twenty nations are represented by visitors to the United States who are now making their headquarters at the branch offices of the Bureau of Foreign and Domestic Commerce, in Washington, and who are seeking new trade relations.

### Advantages of Winter Building.

In a circular published by the Detroit Steel Products Company, advocating a campaign for more building in the winter time, the writer says, among other things:

The question of winter building is one that of necessity must be decided by the owner himself and he is generally not sufficiently informed to take the chance. All kinds of mason work are now carried on successfully at all times during the winter. Buildings of reinforced concrete, depending almost entirely upon concrete for support, are erected in the dead of winter. Mortar will not set as rapidly in winter as in summer, but mortar used in winter will become more durable than mortar used in summer. One reason for this may be that brickwork laid in summer absorbs the moisture from the mortar before it has had time to set.

It is an accepted opinion of the public that contracts for winter work can be let at a lower price than at any other time of the year; all things being normal. It is probable that about 10 per cent. of the cost of the building can be saved if contracts are let during the winter.

The man who erects his building in the winter has the advantage of securing the higher class of workmanship represented by the more competent mechanics who are kept on the payroll during that period. Furthermore, as the contractor and architect are not rushed with the same amount of work as in the summer, each can devote more of his individual time to the construction of the building.

BETTER WOODWORK IS POSSIBLE.

All woodwork which enters into construction of a building is far superior when installed during cold weather, the atmosphere being much dryer than in summer. Much of the moisture in the form of rain which is absorbed by the rough woodwork during warm weather, becomes snow in winter and is easily cleaned off before any material damage can be done. The moisture absorbed by the rough woodwork in summer will not dry out until sometime after the building is completed and decorated. When this moisture dries out floors and partitions often settle, causing cracks and other defects.

One of the greatest objections to summer building is the absorption of moisture from the air by the interior wood finish. This interior finish is one of the most important features of a building, and greater care and skill must be employed in its installation than with any other part of a building. It is always subject to more close inspection as long as a building stands, and it is important that every precaution should be employed to preserve the highest class of workmanship in the building as a whole. The moisture absorbed by the finish woodwork in summer will dry out later and cause joints to open, doors to shrink, panels to crack, and the work to assure the character of a building that literally has been thrown together. On the other hand, heat is maintained in the building erected in the winter, and, as a result, moisture is kept out and the finish remains in a first class condition.

### Operating Costs of Steam and Furnace Heating Plants.

For over a year past the Joliet, Ill., school board which has been making an efficiency test of steam as compared with furnace heated school buildings, has made a report, showing that the furnace blast system is 39½% cheaper in operation than the steam plant, in addition to being more than 25% cheaper at installation.

The figures just made public by Superintendent R. O. Stoops, show that taking three modern steam plants and a like number of furnace blast systems, the comparison favors the furnace blast plants. In both cases the humidity control is taken care of. The essential difference is that in the case of the furnace system, the moisture is introduced into the hot air and the mixed product is conducted throughout the building. In the case of the steam plant, the air to be heated, is drawn through coils,

entailing more power and incidentally more coal, at $2.67 per ton.

The report shows that the board installed the new type of plant, more than a year ago, with heat regulation and humidity control, and that the plant has now been in operation for a year, making comparisons possible.

FIGURES IN DETAIL.

*Cost of heating—furnace blast:*

Moran Street, power and fuel per 1,000 cu. ft., $1.563; Broadway, $1.836; Woodland, $1.868. Average cost, $1.755.

*Cost of heating—steam blast:*

Sheridan school, per 1,000 cu. ft., $2.343; Eliza Kelly, $1.733; Henderson, $3.266. Average cost per 1,000 cu. ft., $2.447.

The report continues: "This shows that the best steam plant costs only 0.135 less to operate than the poorest furnace plant. Local conditions show that this furnace plant (Woodland school) is not doing its best. The above shows that steam costs 39½% more to operate than furnace."

Interest centers in the report in that Plainfield and Aurora have adopted the Joliet system, which, when first installed in Joliet, was untried in this section.

COST OF HEATING PLANTS.

Steam—Sheridan, $5,700; Henderson, $5,560; Eliza Kelly, $6,565. Average per school, $5,941. This does not include all the items of installation.

Furnace blast—Woodland, Moran and Broadway, $14,725, including heat regulation and humidity control. Average per school, $4,925. When this contract was let the job was lumped to one concern.

## Experiences With Humidity.

By A. BEMENT.

Having had an extended experience with the use of steam, taken from the steam heating system in my home, for the purpose of supplying a desirable condition of humidity during the heating season, as well as a much more general experience with steam used elsewhere for the same purpose, a few words regarding that experience may be of interest.

In THE HEATING AND VENTILATING MAGAZINE for January, 1915, at page 24, Dr. Thomas Hubbard says that it is hardly practicable to evaporate sufficient water by means of pans on radiators and registers. This I find to be true to a much greater extent than often realized, also that people often feel that if they keep the pans full of water that they must be getting results, while as a matter of fact such people usually enjoy so little benefit from humidity that they have but a slight idea what it really is.

Dr. Hubbard states that the use of steam is objectionable because of the odor and noise. With reference to the matter of odor, it is my experience that when a radiator or piping is opened for the first time, there is some odor, but that it soon ceases. In my experience in many cases where steam is taken from systems supplied with exhaust steam, and where boiler compound is used, there has not been any case where odor has been an objectionable feature when steam is used for humidification. As to the noise, there is now manufactured a discharge nozzle which emits steam with neither noise or water.

It is my experience that in the central west, the comfortable indoor temperature in the coldest weather may range from 60° to 80° F., depending on the humidity. Comfort at 60°, of course, means high humidity, while 65° represents a more conservative condition. I have frequently changed a temperature of 58° or 60°, prevalent on a winter morning before radiators were turned on, into a comfortably warm condition by raising the humidity without heating.

On two similar cold days, I started in the morning with all radiators on and plenty of steam, but with no moisture supply. At 12:30 noon a comfortable temperature was attained. The next morning the start was made with humidity and the principal radiators air bound by closing the air valves, so that they were half cold. At 8 o'clock A.M. the same comfortable temperature had been attained as was reached several hours later on the previous day. On the first day dry air at 79° insured sufficient warmth, on the second, with humidity, 59° temperature gave the same result.

PRECAUTION IN USING WET AND DRY BULB THERMOMETERS.

In using the wet and dry bulb thermometers of the stationary type, I have found it absolutely essential to direct a strong current of air on them during the reading, as it is only in this way that a proper evaporation on the wet bulb can be secured. I have found for all practical purposes that the readings of the ordinary dry bulb thermometer is a sufficient guide to the prevailing humidity. For example, if 75° to 80° are required for warmth, it is an indication of dry air. If we feel cold at 70°, we know that the humidity is low, but if too warm at that temperature, it is an indication of considerable moisture, and that the temperature should be lowered. Comfort at 65° indicates a good condition. The air with sufficient humidity at temperatures of 60° to 65° is balmy and delightful.

The effect of humidity on the condition of the air is a very interesting one. I have found in crowded offices, with low humidity, where bad air was noticeable by odor, that conditions have been entirely changed by the supply of sufficient moisture. This required the lowering of the temperature, with the result that evidence of bad air disappeared without additional ventilation.

**Comparative Test of Water Heaters.**

A comparative test made recently in Montreal between a No. 5 Old Style Presto heater and a similar heater of another make, disclosed some interesting data regarding the efficiency of this type for hot water heating systems, which was shown to be superior.

The tests were made under regular working conditions on a heating system already installed, in the Recreation Hall of the College of Montreal, and were conducted by Prof. A. Dollo of the Montreal Polytechnic School and A. D. Peck, consulting engineer.

Fig. 1 shows the plan and elevation of the installation of both heaters.

The temperature of the hall at the beginning of the test was 61° F. The temperature of the circulating water was 60° F. The number of cubic feet in the hall to be heated was 311,202; radiator surface used, 4,297 sq. ft., equivalent to 12,892 lineal feet of 1-in. pipe. This gives 72.42 cu. ft. of air per square foot of radiator surface, or 24.13 cu. ft. of air per lineal foot of 1-in. pipe. The boiler was run under a mean pressure of 80 lbs.

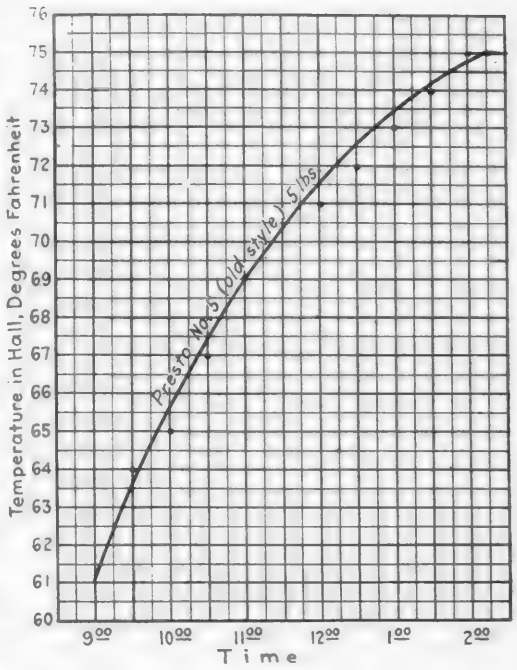


FIG. 2.—CURVE SHOWING RATE OF TEMPERATURE RISE IN HALL.

The mean temperature of the hall during the run was 70.07° F. The maximum inside steam pressure irrespective of steam pressure was 75° F. Fig. 2 is the curve between time and temperature in the hall.

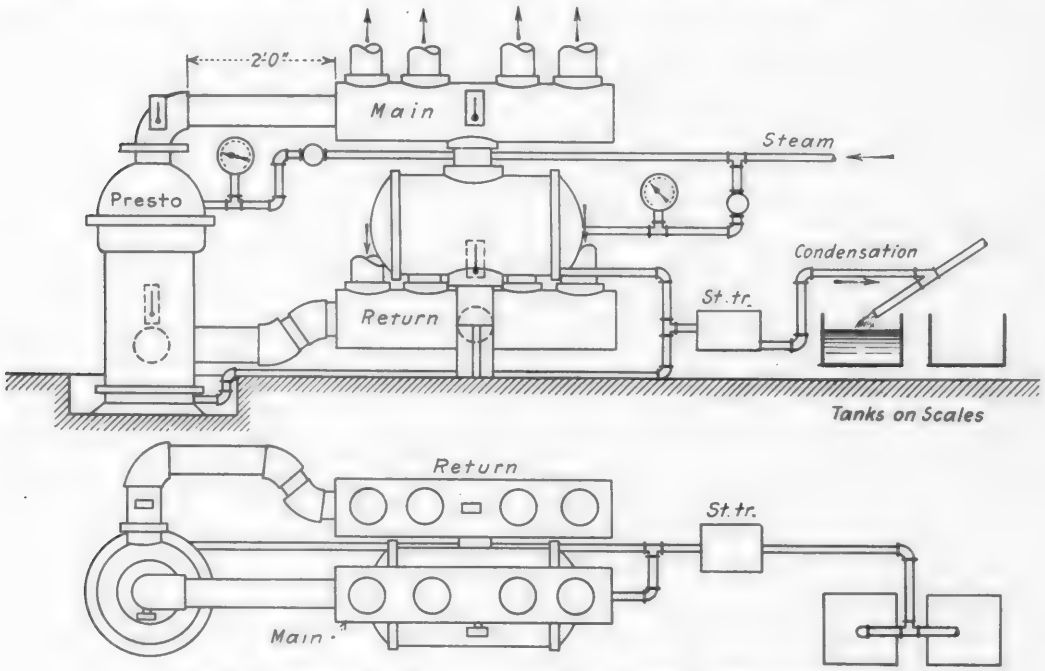


FIG. 1.—PLAN AND ELEVATION OF TEST INSTALLATION.

DURATION OF TEST AND HEAT IN MAIN.

A maximum temperature, at 5 lbs. pressure, of 167° was obtained in the main with the Presto heater after 5 hrs. 20 min. Fig. 3 is a curve drawn between time and temperature in the main. It will be noted that there is a break in the curve from A to B. This is due to the water in the heating system circulating, the hot water going out and the cold water

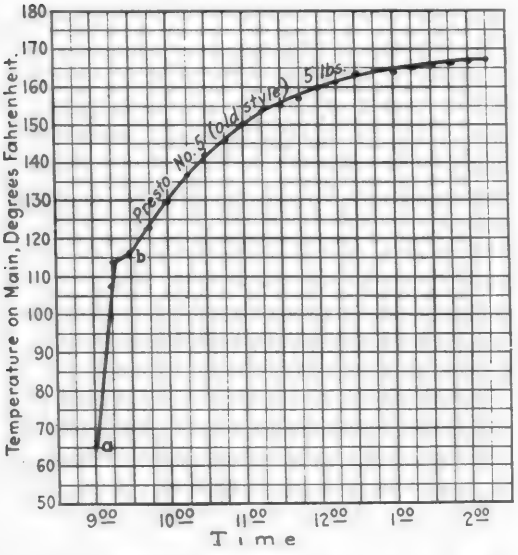


FIG. 3.—CURVE SHOWING RATE OF TEMPERATURE RISE IN THE MAIN.

coming in. It will also be seen from the curve in connection with the velocity of circulation that it took 30 min. to pass all the water of the heating system through the heater.

The total condensation for the heater was 3,879 lbs., the heater using 12.12 lbs. of steam per minute. The total required horse power for the run was 115.13 B. H. P.

Following is a summary of the results obtained with the Presto heater (No. 5, old style):

| | |
|---|---|
| Square feet of heating surface..... | 38.07 |
| Mean temperature in hall, deg. F..... | 70.07 |
| Mean outside temperature, deg. F..... | 54.46 |
| Maximum steam pressure used, lbs.... | 5. |
| Maximum temperature in mains at 5 lbs., deg. F..... | 167. |
| Duration of test to obtain maximum temperature in main, hrs..... | 5.33 |
| Total condensation, pounds..... | 3879. |
| Total boiler horse power used..... | 115.13 |

The Presto heater is manufactured by the Harris Construction Co., Ltd., Montreal, Can., and its showing in this test, where it produced the higher results, is followed by a statement from the manufacturers that they are prepared to make a test of the same nature with any other kind of heater on the market.

# CORRESPONDENCE

**Contractors' Guarantee of Heating Installations.**

Editor HEATING AND VENTILATING MAGAZINE:

We are suing a man on account of some additional radiation that we put in his residence last winter, as he said the house was not warm enough to suit him. After the work was all done he refused to pay for it as he said it was up to us to heat the house to 70° inside, when the outside temperature was 10° below zero, according to the original plans and specifications, and the architects are upholding him in his contention.

The architects had a heating engineer lay out the plans and write the specifications for them, showing the size of the pipes and the location of the radiators, etc., and we installed the system in strict accordance with the lay-out. The work was completed in the spring of 1912, and the following winter the owner decided he wanted more radiation and it was put in by us and paid for by the engineering firm.

We desire to know if you have any record of similar cases that were settled in the courts and what the outcome of them was.

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This matter has been up for debate many times before the heating engineers' society and other bodies. The following is one of the most recent decisions having a bearing on the subject:

GUARANTY OF CAPACITY OF HEATING PLANT.

In an action against a contractor for breach of his agreement to install a heating plant sufficient to heat a building to a certain temperature in cold weather, the plaintiff sought to recover for additional expense of employing another party to remedy the plant. It was held that under the contract and the evidence the defendant was liable for at least nominal damages, but that a judgment could not be sustained for the cost of completing the plant in the absence of evidence showing that the additional work and materials furnished were necessarily required to make the plant comply with the contract. It was also held that the contractor was liable on his guaranty though the owner had him place seats over some of the radiators, the contract expressly giving the owner the right to make such changes, to be paid

for as extras, without invalidating the contract, and the contractor not asking for a modification of his guaranty. The owner, it was held, did not waive his right to insist upon the guaranty by his accepting a written guaranty of the subcontractor made to the contractor, or because the contractor refused to guarantee the plant after the house was finished.—Baylies vs. Bent, 185 Ill App., 437.

Some years ago the heating engineers' society discussed the subject in connection with the following topic that was placed on the programme: "Should the guarantee of efficiency be assumed by the heating engineer who designs the apparatus, or by the heating contractor, who installs it?" The ground was taken and generally endorsed by the speakers that if the engineer is not capable of laying out work to produce results he should not throw responsibility of his failure on the contractor. One speaker, however, called attention to the point that it was not always for the engineer to guarantee results. He instanced a case where a cerificate was issued even though it was known that a certain part of the building was not heated satisfactorily. It appeared, in that case, that the construction had been changed to put in swinging windows, swinging out, and these windows were operated by a series of chains. Owing to their construction 80 per cent. of the windows were open ¾ of an inch and they could not be closed.

The same speaker said he knew of cases where the courts have ruled that the contractor cannot be required to guarantee results to be obtained from plans and specifications furnished him. One was in connection with the construction of a steel bridge which should stand a test of so many tons per square foot and show a deflection of not more than so many inches. The bridge was constructed according to the plans and under the supervision of the county's engineer. The county rejected the bridge. The contractor took the matter into court and the court ruled, and was sustained by the Court of Appeals, that the contractor should not be required to guarantee the figures of the engineer.

The same thing happened in connection with the construction of the basement in one of the New York public schools, where there was inserted a guarantee in the specifications in the matter of making the basement watertight. The requirements specified the thickness and foundation of the walls, that they should be waterproof, the method of doing it, etc. The cellar leaked like a sieve and the owners refused to pay for it. They went to court and, finally, to the Court of Appeals, and it was decided that if the owners employed a competent engineer, the contractor should not assume the responsibility.

C. B. J. Snyder, architect of the New York City Department of Education, and at that time president of the heating engineers' society, corroborated the foregoing by stating:

"The point under discussion has been carried into the courts of every State in the Union. One of the most famous decisions is that in reference to the 54th Street Court House in New York. One of the provisions of the contract was that the cellar was to be built in a particular manner, which was clearly specified, and, further, was also to be guaranteed water-tight. The contractor erected the building according to specifications, but the cellar was not water-tight. The court decided that the contractor could not be held both to build according to specifications and also to guarantee results.

"In order to cover this point, the corporation counsel of New York City has requested the heads of departments to insert in specifications a clause that if the contractor is not satisfied that the requirements of the specifications will result in making the guarantee possible, then he shall submit with his bid a brief statement of such changes as he desires to have made therein that will enable him to give the guarantee required."

The fact is that if a contractor accepts any layout and bases his contract on the plans, giving a guarantee, it makes very little difference who drew the plans, for he can be held for them. But if his contract is simply to heat the house to a certain temperature, without specific reference to any plans, he can still be held for it, but he cannot be obliged to carry them out, except in so far as may be specifically stated in the contract.

### Cleveland to Hold Building Show.

What is described as the first American complete building show will be held in Cleveland, O., February 16 to 26, 1916, under the direction of the Cleveland Chapter, A. I. A., in co-operation with the Cleveland Chamber of Commerce, Art Association, Builders' Exchange and other civic bodies. One of the features of the show will be an architectural competition for a workingman's home to cost not more than $3,000 complete, exclusive of land and embellishments. There are seven prizes, the first being $200. The contest is open to all materials. The rules of the competition call for six rooms, with basement under entire house. All drawings must be in by February 1. Instructions regarding the contest may be obtained by applying to the Complete Building Show Co., 356 Leader-News Building, Cleveland.

# NEW DEVICES

### H-and-C Hot Blast Radiator.

The accompanying illustrations show the construction of the new H-and-C hot blast radiator, which has recently been placed on the market by the Hart & Crouse Co., Utica, N. Y. This apparatus is the invention of William M. Kingsbury, formerly engineer for the Cleveland (Ohio) Board of Education. The H-and-C is a sectional base radiator. The base, which is of cast-iron, as are also the radiator sections, has a vertical longitudinal partition which divides it into a supply side and a return side. This construction avoids the difficulty sometimes experienced with pipe blast coils, when the base was made too long and the heating surface in the pipes too great for the cross section of the supply side, in that the high velocity of the steam is entering the base backed up by the water in front of it, thus preventing the water from flowing back to the drip pocket provided, and resulting in a part of the heating pipes being sealed off with water.

This difficulty has been overcome in the H-and-C radiator by casting a horizontal partition the width of the supply side of the base near the bottom, the end furthest from the supply opening being cut off within 1½-in. of the end of the base. This provides a space for the water to fall over into the lower drip chamber and permits it to flow back to the drip opening below the supply connection, without coming in contact with the incoming steam.

The radiator section is made with a vertical transverse partition corresponding with the partition in the base, which ends within a couple of inches of the top, leaving a means of communication between the two sides of the section near the top.

The steam enters from one side of the base, rising on the corresponding side of the section, and passes over the top of the partition, dropping down on the return side, compelling a complete circulation of the steam and perfect venting.

The entire construction is such as to permit the use of high steam pressures.

The sections are connected to the base by push nipples and tightened with bolts. The top of each section is made with a flat flange so that when a number of them are assembled in a row, they form a natural platform on which to set another base, and make the radiator two or more tiers high.

Face View Edge View

H-AND-C RADIATOR SECTION

Emphasis is laid on the ease and simplicity with which these blast radiators may be assembled, the radiator being made up into stacks with single sections having no screwed or gasket joints. Each section is mounted on a base independently .

In a catalogue just issued, carefully compiled tables are included covering tappings, heating surface, net air space, lengths, widths, centers and tiering.

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### A New Steam Pump.

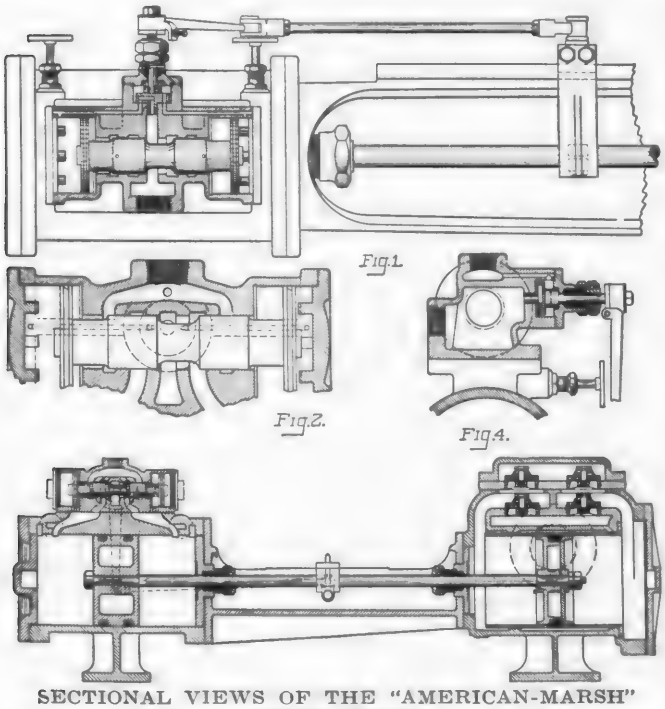
A steam pump with a new type of valve gear, embodying unique features, has recently been placed on the market by the American Steam Pump Co., Battle Creek, Mich. It is known as the American-Marsh, this name being chosen in order to identify it with this company's line of American and Marsh Pumps. As will be noted from

the accompanying illustration, this new pump has a steam valve which is mechanically actuated and also self-governing. The fact that it is mechanically actuated is designed to insure positive action at all times, while the self-governing device allows only enough steam to enter the pump to do the required work. This feature is intended to reduce the steam consumption to a minimum.

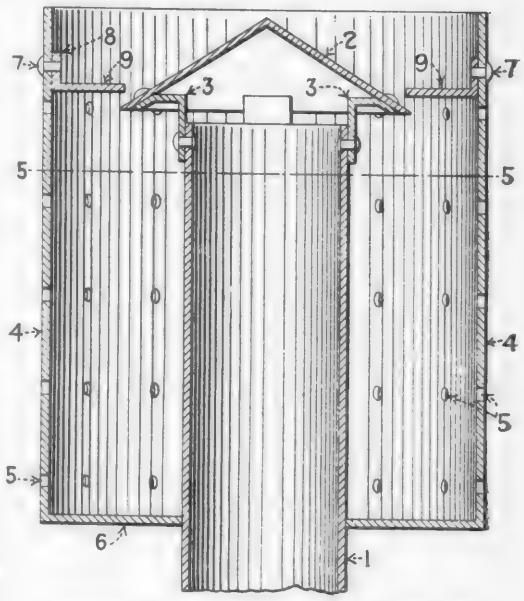
The construction of the pump is comparatively simple. The steam valve is of the valanced piston type, equipped with exansion rings, while the auxiliary valve is of the semi-rotative disc type which wears to a perfect seat. There are no slide valves and no loose links or tappets in the valve gear. In action it is claimed to be quiet.

Because of the ingeniously-constructed valve gear, it is claimed that the American-Marsh pump cannot hang up, even under the most severe conditions and even if the suction line is broken the pump will not race. The length of the stroke is regulated by two adjusting screws located at the fulcrum of the lever arm.

Because of their smooth action, American-Marsh pumps are especially adapted for use as vacuum pumps on heating systems and the manufacturers have recently issued a bulletin known as "No. 24," illustrating and describing this new type of pump.




SECTIONAL VIEWS OF THE "AMERICAN-MARSH" STEAM PUMP.




ASHORN VENTILATOR AND SPARK ARRESTER.

**A Combined Ventilator and Spark Arrester.**

A ventilating cowl, so designed that it serves at the same time as a spark arrester, is an interesting device that has just been patented by I. Ashorn, of New Ulm, Texas. It is listed as patent No. 1,162,205, issued March 30, 1915, and as patent No. 163,846 for Canada, issued July 20, 1915.

As will be noted from the illustration, smoke, air and sparks passing up through the flue will strike the cap 2, the smoke and air being deflected thereby and caused to pass out under the lower edge of said cap, when it will again rise and pass out between the cap and ring 7 into the atmosphere.

By its design, the cowl is intended to be not only a ventilator, preventing the smoking of any stove or chimney, no matter what the direction of the wind may be, or whether the flue ends below or above the top of the roof, but one of the main functions of the cowl is its use as a spark arrester, as it has been found to positively arrest both sparks and burning soot which had passed through the flue upon which the cowl is placed. It is stated that two-thirds of all fires originate on

wooden buildings by sparks or burning soot falling on roofs.

Either or both of the patents on this cowl will be sold to the highest bidder by March 1, 1916.

A number of the Ashorn ventilators and spark arresters are already in use. The weight of each cowl is 5 lbs. It is made of galvanized iron and sells at $2.60, parcel post paid.

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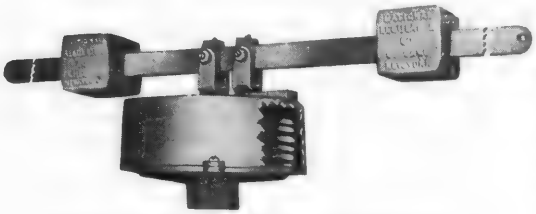
**Use of Metaphram As a Damper Regulator.**

The availability of the "Metaphram" valve for use in connection with a damper regulator, has led the manufacturers of this device, the National Regulator Co., of Chicago, to develop a new line of damper regulators in which the "Metaphram" is the distinguishing feature. When assembled, the "Metaphram," which is composed of a plurality of separable, collapsible corrugated metal disks connected by threaded studs, collapses of its own inertia, and is so constructed that when inflated, the disks are in contact with each other, utilizing all the initial power throughout their travel and exerting unusual strength. The advantage of the metal diaphragm for use in connection with diaphragm motors for actuating dampers, damper regulators, etc., will be seen when it



METAPHRAM DAMPER REGULATOR.

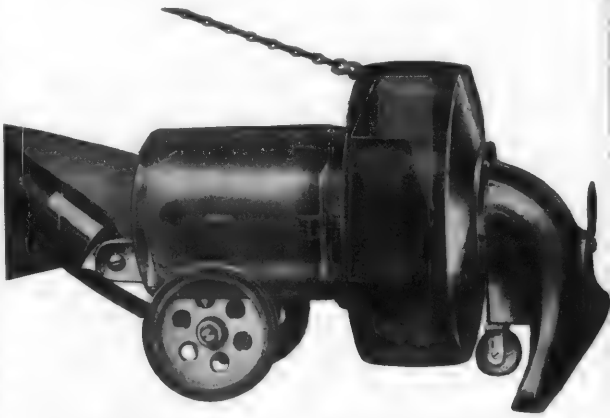
is noticed that the metaphragm is made of metal throughout and has no rubber or other substance in its construction. They are designed for any shape of boiler, round or square, and operate on ounces between 0 and 5 lbs. pressure. A universal adjustment feature makes them applicable for pressure or vapor by changing the fulcrum position and shifting the weights and lever.

The manufacturers state, however, that the introduction of this valve does not indicate by any means the passing of the rubber diaphragms, its use being intended for conditions where the life of rubber has its limitations.

In further developments of this device the manufacturers announce that they are now making a "Metaphragm" boiler regulator of hot and cold water, milk pasteurizers and other commercial control.

**The Magic Vacuum Cleaner.**

An interesting type of portable vacuum cleaner is manufactured by the Innovation Electric Co., Inc., 585-589 Hudson Street, New York. The accompanying illustration shows the construction of this cleaner, which is claimed to be unusually efficient. It comprises a horizontal mounted motor and a 6-in. turbine fan enclosed in an aluminum base. It will operate on either direct or alternating current, 100 to 125 volts and



CONSTRUCTION OF MAGIC VACUUM CLEANER.

25 to 70 cycles. The weight of the apparatus is 12 lbs., height 7½ in., length 10½ in. and width of nozzle 12 in. The cleaner is supported on three wheels which contribute to its ease in running. The manufacturers emphasize the hand control of the nozzle by automatic catch as, with this arrangement, the nozzle can be raised from the floor without lifting the cleaner bodily.

REVERSIBLE NOZZLE BRUSH

This brush may be turned out of the way, when the cleaner will remove deep-seated dirt.

A push button switch is located in the pistol grip handle. It is stated that the Magic is the only cleaner having double dust bags.

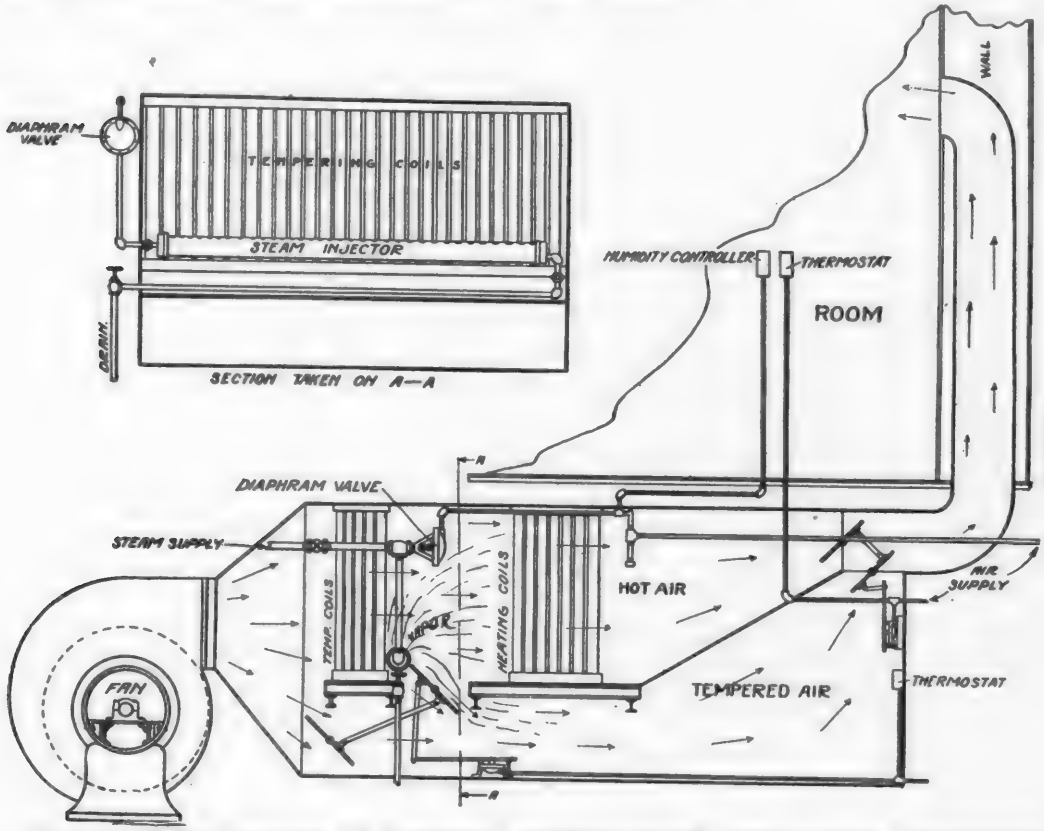
The company also manufactures the Liberty Cleaner, which has the exclusive feature of a reversible nozzle brush which may be turned out of the way when the cleaner is removing deep-seated dirt. This is also a portable cleaner.

## Trade Literature.

ESTABLISHING AND MAINTAINING BOILER ROOM ECONOMY is the title of a paper presented before the Ohio Society of Mechanical, Electrical and Steam Engineers by George H. Gibson, developing the thesis that the most important requisites to further improvements in boiler room economy are means of recording boiler performance; that is, of determining the number of pounds of water evaporated per pound of coal. This pamphlet is being distributed by the Harrison Safety Boiler Works, 3189 No. 17th street, Philadelphia, Pa.

ECONOMY PUMPING MACHINERY, including Economy automatic condensation pumps and receivers, direct-acting vacuum pumps for heating systems, centrifugal pumps for various services, sewage ejectors, bilge pumps, etc., is the subject of a carefully prepared catalogue issued by the Economy Pumping Machinery Co., Chicago, Ill. The entire line is backed by the company's guarantee. The description of each pump is accompanied by a suggestive specification, together with all the necessary data for figuring the sizes required and similar matters. The Economy standard automatic condensation pump and receiver is one of the company's most interesting products, being designed to take the place of a receiving tank and a boiler feed pump. Each unit consists of an expansion tank, a centrifugal pump and an automatic switch and electric motor. This apparatus is made in three sizes, for draining 10,000 sq. ft. of direct radiation, for draining 45,000 sq. ft., and the third size built to meet practically any condition. Size 6 x 9 in. (standard). Pp. 83.

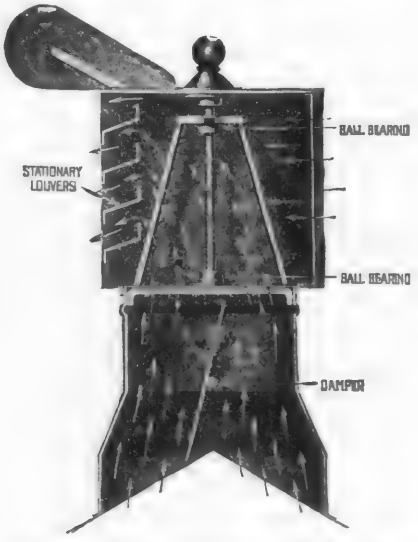
AUTOMATIC TEMPERATURE REGULATORS, comprising the product of the National Regulator Co., Chicago, Ill., are described in an impressive catalogue showing the extent of the company's line of instruments for automatically controlling hot air, steam or hot water heating apparatus, together with specially-designed apparatus for the automatic control of hot water tanks, ovens, etc. Some idea of the extensive use of National regulators may be gained by the illustrations of representative buildings throughout the country in which National apparatus has been installed, controlling both direct and indirect heating and ventilating systems. These illustrations take up 46 pages of the catalogue and range from the People's Gas Building, in Chicago, to residences, churches and private residences in various cities. Size 9 x 6 in. (bound in separate sheets).



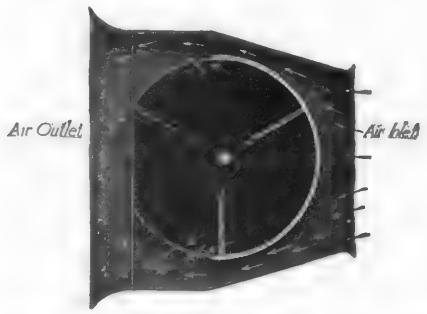

TYPICAL INSTALLATION OF NATIONAL TEMPERATURE REGULATING APPARATUS IN CHICAGO PUBLIC SCHOOLS

THE COMMERCIAL VALUE OF FRESH AIR, demonstrating the beneficial effects of properly conditioned air upon the productive capacity of workers, is the title of a recent publication of the American Blower Co., Detroit, Mich., featuring the Sirocco air conditioning system. Many interesting quotations are included from ventilation authorities showing the practical value of clean, as well as humidified air. This is followed by "The History of 'Sirocco' Washed Air," in which is traced the development of the Sirocco apparatus from the McCreery air washers. Credit is given to Joseph McCreery as being the first patentee (1897) of an all metal air cleanser. .The latter part of the catalogue is devoted to the requirements of air purification and the various types of Sirocco purifiers are here taken up in detail. Size 8½ x 11 in. (standard). Punched for binding. Pp. 44.

BURT REVOLVING BALL BEARING VENTILATORS are featured in newly-issued circulars sent out by the Burt Mfg. Co., Akron, O. In this novel design, advantage is not only taken of the air currents that pass over the top and sides of the ventilator, but provision is made to allow the air to pass directly through the ventilator, thereby creating a partial vacuum in the air shaft and increasing the ventilator's pulling power. This same construction also has a tendency to hold the ventilator steady with the wind, thus overcoming the whirling motion. It is equipped with two sets of ball bearings made from the same gauge of iron as that used in the company's sliding sleeve ventilator. It is made in 15 sizes, ranging from 12 in. diameter of neck to 72 in.




BURT BALL-BEARING REVOLVING VENTILATOR



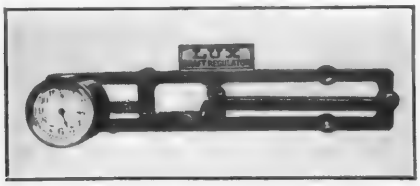

COURSE OF AIR THROUGH BURT BALL-BEARING VENTILATOR

CARRIER ENGINEERING CORPORATION, New York, "the organization that developed air conditioning," is the title of a timely booklet in which air conditioning is discussed in general, showing the part the Carrier organization has had in its development. The illustrations include portraits of Willis H. Carrier, president and chief engineer; J. I. Lyle, treasurer and general manager; E. T. Murphy, secretary and Philadelphia manager; E. T. Lyle, Boston manager; Alfred E. Stacey, Jr., western manager; L. L. Lewis, designing engineer, and H. P. Heckel, superintendent of construction. An idea of the various industries which have been served by this organization is shown by a partial list of the company's clients, which is included in the booklet. Size 4¾ x 7 in. Pp. 16.

HERBERT BOILERS FOR STEAM AND HOT WATER, including the Herbert patent smoke-consuming boilers, garbage burners, heaters and tanks, are presented in a new catalogue for 1916, issued by the Herbert Boiler Co., Chicago, Ill. The Herbert down-draft principle of combustion is explained in detail. Special attention is called to the liberal room provided in this boiler for the expansion of the gases after leaving the firebox. The arrangement of the heating surface is also emphasized and the claim is made that the Herbert is the quickest steaming boiler on the market. The catalogue also shows the Herbert down-draft detachable firebox for tubular boilers, which, it is stated, may be applied to any standard horizontal tubular boiler. Other products of the company included in the catalogue are the Chicago down-draft smokeless boiler for buildings with shallow basements, the Herbert Junior all-steel boilers and Herbert garbage burning water heaters. Size 9¼ x 6 in. Pp. 68.

LUX DRAFT REGULATOR, designed to operate in connection wth any type of heater, is described in a circular issued by the Lux Mfg. Co., Washington, D. C. The company calls attention to the strong construction of this damper regulator, which is made of cast-iron, while the clock used is hinged to the frame,

thus preventing its falling when winding. Attenton is called to the fact that this device



LUX DRAFT REGULATOR

is a draft opener and not a heat controller and is especially useful in opening the drafts at a predetermined time in the early morning.

STEAM SPECIALTIES, devoted to the product of the Steam Appliance Co., Milwaukee, Wis., are treated in a handy catalogue received from that company. The company's products include the Triumph line of oil separators, the Victor steam separators, Triumph exhaust head, Peters improved Corliss valve steam traps and grease traps; also the Peters water line governors, Henry steam flue cleaners and White's improved hollow base grate bars. The catalogue includes a long list of satisfied users. Size 5½ x 8 in. Pp. 78.

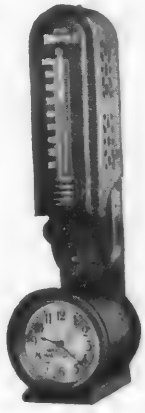
MUELLER RECORD for Christmas, 1915, being the holiday number of the Mueller Record, published by the H. Mueller Mfg. Co., Decatur, Ill., is a unique number in which the Christmas spirit is given full expression. Interspersed with company matters are such classics as "The Moonbeam's Story," by Eugene Field; "Is There a Santa Claus," by Frank P. Church; "History and Legends of Christmas;" and "Old Scrooge and Christmas," by Charles Dickens. A double page is devoted to the pictures of twenty men who have completed twenty years of faithful service with the Mueller Company and who received a gift of $500 each as a reward.

GOLDEN-ANDERSON STEAM AND WATER SPECIALTIES are brought to the attention of the trade in a catalogue comprising the full line of the Golden-Anderson Valve Specialty Co., Chicago, Ill. Among the products featured is the Golden-Anderson automatic cushioned valves. The double "Corliss dashpot" method of cushioning these valves is employed, occupying the full area of the upper portion of the body, insuring a positive cushion in the opening and closing of the valves and alignment with the seat at all times, regardless of position. The catalogue is well arranged and shows the interior construction of each device. Size 6 x 9 in. (standard). Pp. 140.

PIERCE FITTER'S BOOK, published by the Pierce, Butler & Pierce Mfg. Corporation, whose headquarters are now in New York City, at 437 East 162d St., has been sent out to the trade, superseding the previous editions of this manual. The company's well-known line of Pierce American, Down Draft, Spence, and Touraine boilers, as well as its various types and styles of radiators, are listed, with all necessary details, also the company's water boilers for domestic use, firebox boilers and garbage burners. Size 3⅞ in. x 6¾ in. Pp. 262.

LAGONDA CUT-OFF VALVES, made by the Lagonda Mfg. Co., Springfield, O., are the subject of a new 24-page bulletin devoted to the company's line of triple-acting, automatic cut-off valves. These include the standard angle type and straight-way valve, the low, squat body valve for low headroom and the horizontal valve. Size 7½ in. x 10 in.

MINNEAPOLIS DUPLEX THERMOSTAT, equipped with an 8-day automatic time adjustment (Model 55), with two actions each 24 hrs., is a recent product of the Minneapolis Heat Regulator Co., Minneapolis, Minn. The thermostat mechanism is so arranged that at night, automatically, the thermostat pointer is moved back to the night temperature, and again in the



NEW MODEL OF MINNEAPOLIS DUPLEX THERMOSTAT.

morning, at the predetermined hour, is moved forward to the day temperature. This action is performed independently of the clock. The thermostat pointer can also be moved entirely independent of the clock mechanism and its operation by hand does not affect its automatic operation. That is, the clock is never disengaged and is in control at all times.

OVERSHADOWING SUPREMACY is the title of a recent circular issued by the National Tube Co., Pittsburgh, Pa., calling attention to its award of the grand prize by the Panama-Pacific International Exposition, for its display, and explaining the distinctions between the grand prize and the other awards, such as medal of honor, gold medal, silver medal and bronze medal. For each class there is but

one grand prize, so that only one exhibit of tubular and allied products could secure this distinction.

**Three New Municipal Heating Plants Built During 1915.**

Reports of district heating activities during the year show that three new municipal heating plants were built in 1915. One of these plants is located at Alexandria, Minn., and was built by F. A. Blakeslee & Sons, Minneapolis. The other two are in Springfield, Minn., and Worthington, Minn., built by J. E. Robb, Wadena, Minn. The engineer for all three installations was L. A. Larsen, St. Paul, Minn. In each case the fittings and meters installed were those of the Central Station Steam Company make. The pipe covering for the Alexandria and Springfield installations were of the H. W. Johns-Manville Company make, while in Worthington the covering of the Milwaukee Conduit & Insulation Company was installed.

**Organization of Batterman-Truitt Co.**

A new firm of specialists in heating, ventilating, exhaust and drying systems has been formed in Chicago under the name of the Batterman-Truitt Co., with offices at 32 West Washington Street. The firm will handle the Bicalky Fan Company's line of fans, blowers, exhausters and other apparatus within the central and western states. The principals are F. W. Batterman, formerly Chicago representative, who is president of the new concern; and J. E. Truitt, formerly Chicago sales manager for the Ilg Electric Ventilating Co., who is secretary and treasurer. The new company states that it will carry a complete stock of all the standard sizes of fans in Chicago territory, which will permit prompt shipments at all times.

F. W. Ballard & Co., engineers, Cleveland, O., is the title of a new engineering firm with offices in the Swetland Building. Mr. Ballard, the head of the firm, was until recently light and heat commissioner of Cleveland, and had direct supervision of the municipally-owned light and heating system which is operated in that city. The new firm will specialize in the building and operation of municipal electric light and power plants.

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# TRADE AND MISCELLANEOUS NOTES

### Coming Events.

**January 18-20, 1916.**—Annual meeting of The American Society of Heating and Ventilating Engineers, at the Engineering Societies' Building, 29 West 39th Street, New York. Secretary, J. J. Blackmore.

### Miscellaneous Notes.

**Building Operations** for November continue the good showing made during the past two months, the average increase being 75%, covering reports made to the American Contractor from 71 cities. Gains were made by most of the larger cities, including Boston, with a gain of 122% over the corresponding month in 1914; Chicago, 67%; Cleveland, 13%; Detroit, 215%; Indianapolis, 65%; Newark, 72%; New York City, 163%; Philadelphia, 94%, and St. Louis, 20%. The only notable losses were reported from Portland, a decrease of 53%, and Tacoma, 109%. The figures for New York totalled $14,241,740, as against $5,403,693 a year ago. The total for the 71 cities was $60,129,378, against $34,342,475 for November, 1914.

**Seattle, Wash.**—A tunnel from the Mines Building to the heating plant for the University of Washington, to carry the main trunk line of steam pipes, is being planned by Professor E. O. Eastman, consulting engineer of the university. The work will cost $10,000.

**Chicago, Ill.**—A proposed ordinance providing for the licensing of heating and ventilating contractors has been drawn up by a committee representing the Allied Sheet Metal Contractors' Association of Chicago. The proposed ordinance will be sent first to the Chicago Department of Ventilation for its approval, after which it is planned to submit it to the corporation counsel and then to the city council.

**American Institute of Metals** elected the

**Genuine Armstrong Stocks and Dies**

**MALLEABLE HINGED PIPE VISES**

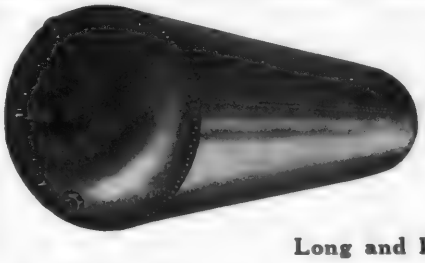
**PIPE CUTTERS**

**PIPE MACHINES, HAND OR POWER**

*The Tools of Constant Service*

Manufactured by — Write for Catalog

**THE ARMSTRONG MFG. CO., 321 Knowlton St., BRIDGEPORT, CONN.**



**"THE DAHLQUIST"**

**Copper Hot Water Boilers**

**For Large Apartment Houses, Hotels, Hospitals, Restaurants, and Public Institutions.**

**Long and Reliable Service Guaranteed.**

**Engineers** recognize the high character of our product by specifying "The Dahlquist Boilers" on their most exacting work. Write for catalogues

**DAHLQUIST MFG. CO., 40 West 3rd Street, BOSTON, MASS**

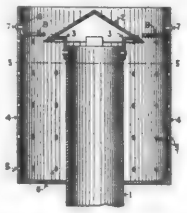
*Please mention* THE HEATING AND VENTILATING MAGAZINE *when you write.*

following officers at its recent annual meeting: President, Jesse L. Jones, Westinghouse Electric & Mfg. Co., Pittsburgh; secretary-treasurer, W. M. Corse, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.; vice-presidents, R. S. B. Wallace, National Cash Register Co., Dayton, O.; George C. Stone, New Jersey Zinc Co., New York; W. G. Harris, Canada Metal Co., Toronto, Ont.; E. B. Horne, Packard Motor Car Co., Detroit; W. B. Price, Scovill Mfg. Co., Waterbury, Conn.; E. A. Barnes, Fort Wayne Electric Co., Fort Wayne, Ind.; Dr. G. K. Burgess, Bureau of Standards, Washington, D. C.; F. H. Schultz, Mueller Mfg. Co., Decatur, Ill.; H. S. Gulick, Moore-Jones Brass & Metal Co., St. Louis, Mo., and de Courcey Browne, Goldschmidt Thermit Co., New York.

**National Association of Master Plumbers,** through President James S. Cassedy, announces that since the per capita tax was increased to $4.00, indictments have been found against 33 of the association's members in Erie, Pa., and 14 in Salt Lake City, Utah, so that the amount derived from the present tax will all be needed in defending these and other cases. The Des Moines case, which was appealed, will be argued, it is expected, on January 10. President Cassedy states that the association's membership is increasing and that there are less than the usual mid-year losses.

**"Good Ventilation Guaranteed"** is the kind of sign which the Dubuque (Ia.) Times says every church, theatre or lecture hall will have to display outside the main doors ten years from now if it is hoped to draw an audience.

**Milwaukee, Wis.**—Under a new ordinance passed by the common council of Milwaukee, an inspector of heating plants will be employed by Building Inspector W. D. Harper, commencing January 1. The inspector will spend his spare time examining old heating plants and he will also pass on the specifications of every installation. The purpose of this service is to reduce fire hazards and to eliminate defective plants. In this connection a proposed ordinance has been introduced before the common council which directs that a permit from the building inspector be obtained for the installation of a heating plant, carrying a fee of $1.00. As this ordinance, if passed, will bring in about $6,000 annually to the city treasury, it will make the office of the inspector of heating plants

**AN IMPORTANT BUSINESS OPPORTUNITY**

**All rights in the**

**ASHORN VENTILATOR and SPARK ARRESTER**

**will be sold to the highest bidder whose bid is received by March 1, 1916**

This device is not only a perfect ventilator, preventing the smoking of any stove or chimney, no matter from where the wind blows or whether the flue ends below or above the top of the roof, but also a protection against fires, because it positively arrests any spark or burning soot passing through the flue.

For further details address

**WILLIAM HAGEMANN,** NEW ULM, TEXAS

**RELIABLE**

**Vacuum and Vacu-Vapor Heating Equipment is Really RELIABLE**

**The BISHOP-BABCOCK-BECKER CO.**

**Manufacturers, CLEVELAND, O.**

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self-supporting. The salary of the inspector will be $1,200 a year.

**Chicago, Ill.**—In connection with the fresh-air surface cars being run on the elevated lines in Chicago, the company has devoted sixty cars for such use, five being operated on each of twelve lines. Varying opinions of the advantages of the innovation have brought forth the expression from President Leonard A. Busby, of the Chicago surface lines, speaking before the Institute of Electrical Engineers, that "the reformers and faddists don't know what they want. One passenger wants heat regardless of ventilation and complains. Another wants fresh air regardless of anything else, and complains. And what are we, who get the complaints, going to do?"

**Iowa Falls, Ia.**—Cornell College trustees have completed arrangements for building a large central heating plant to cost $75,000 to heat the college buildings. A campaign for new buildings and an increased endowment will be pushed.

**Muscatine, Ia.**—Although the D. and M. Railway Company will not be obliged to heat the vestibules of its local street cars until May 1, experiments are now being made with a new electric vestibule heater, which is of the same type as those used in the interior of cars. In this case it is placed under the car platform. It is planned to equip all of the local cars with this or a similar type of heater.

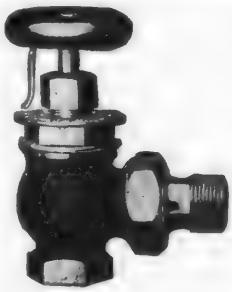
**"Canned Heat"** is the commercial name given to a preparation of solid alcohol that is being used extensively in the European war as a fuel. It burns with a light blue flame, and, it is said, gives off no smoke. One form of this product, known as Sterno's "Canned Heat," is being marketed by S. Sternau & Co., New York.

**Jonesboro, Ark.**—The central heating and lighting plant of the State Agricultural School, which is nearing completion, was tested recently and found to be in a satisfactory condition. The plant includes a 7-ft. concrete tunnel 1,000 ft. in length through which are carried the steam and water lines.

**Muskegon, Mich.**—As the result of an agitation for better ventilation in the school buildings of Muskegon, the Watt ventilating system, designed by W. E. Watt, has been installed in the Froebel School, in that city and a similar system will be installed in the Horace Mann School.

**Chicago, Ill.**—The Builders' Association of Chicago has adopted a suggestion to send five copies of the Illinois form of contract documents to each of its members, with the request that they be used in making contracts with architects and owners for any work that may be awarded. The Builders' Association includes many heating and plumbing firms.

**National Association of Master Plumbers** has organized an "Educational Bureau," which was authorized at the last convention in Chicago. The following officers of the bureau have been appointed by President James S. Cassedy: Chairman, E. J. Hanley, St. Louis, Mo.; secretary, E. J. Blake, St. Louis, Mo.; advisory committee: W. J. Woolley, Evansville, Ind.; Robert H. Pflug-

**Jenkins Bros. Fractional Radiator Valves**

For use in connection with Atmospheric, Vapor, and Vacuum Return Line Systems.

Open wide in five-sixths of a turn. Opening is correctly graduated and partial heating of the radiator is easily controlled. The large and plainly marked indicator plate is adjustable and marking can be set to any point in the circle. The Jenkins Bros. Disc. standard of design, metal and workmanship, is an assurance of quality and satisfaction.

Write for catalogue No. 20.

**JENKINS BROS., New York, Boston, Philadelphia, Chicago, Montreal, London**

**SPECIFY FOXBORO TRADE MARK THERMOMETERS**

**THE FOXBORO COMPANY** Succeeding The Industrial Instrument Co.

New York Chicago FOXBORO, MASS., U. S. A. San Francisco St. Louis

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felder, Philadelphia, and H. F. Baillet, Newark, N. J. The headquarters of the bureau are at 214 Mermod-Jacard Building, St. Louis, where it will receive and tabulate information on costs, systems of business management, expense accounts and costs of overhead expense, scale of wages, etc., all of which will be at the disposal of members of the association.

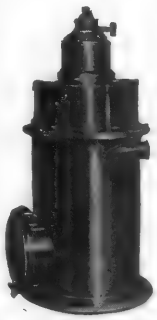
**National Committee of Confederated Supply Associations** elected the following officers at its annual meeting in New York: President, J. J. Ryan, J. J. Ryan & Co., Chicago; vice-president, W. A. Myler, Standard Sanitary Mfg. Co., Pittsburgh; treasurer, L. O. Koven, L. O. Koven & Bro., New York; secretary, Frank S. Hanley, 261 Broadway, New York; board of directors, J. J. Ryan, W. A. Myler, L. O. Koven, F. W. Hubbard, W. B. Hubbard & Sons Co., Boston; S. E. Hunting, the Hunting Co., Watertown, N. Y.; F. D. Keeler, the Rockford Brass Works, Rockford, Ill.

**Cincinnati, O.**—New building projects in Cincinnati are the second section of the Hyde Park School, $500,000; Y. M. C. A. building, $400,000, and the 12-story addition to the Provident Savings Bank & Trust Co., $125,000.

**Atlanta, Ga.**—A State organization of steam and hot water heating engineers and contractors was effected at a meeting in Atlanta, November 18. Officers were elected as follows: President, A. M. Smith, Smith & Guest, Atlanta; vice-president, W. T. Burlington, Macon. The president was given authority to name a secretary.

### Central Station Heating Notes.

**Seattle, Wash.**—The contract for heating the new county building at Third Avenue and James Street with steam has been awarded to the Puget Sound Traction, Light & Power Co., at an approximate rate of $8,000 per annum. Under an agreement with the city, which will occupy two-fifths of the building, the company will furnish the city heat at one-half the commercial rate, which will make the rate for the



¾ H.P. Equipment

**Spencer Turbine Vacuum Cleaners**

**are manufactured in sizes from ¾ H. P. to 40 H. P.**

*Send for catalogue*

**SPENCER TURBINE CLEANER COMPANY**

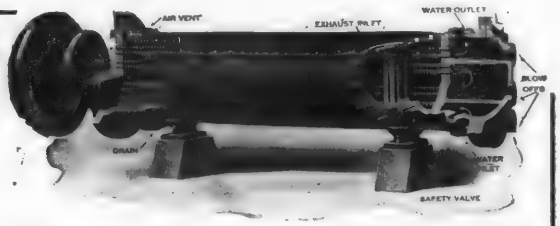
HARTFORD, CT.

**Correct Engineering Principles**

are followed in the construction of the

**ALBERGER MULTI-HEAD WATER HEATERS**

**Horizontal or Vertical**




Proper provision is made for expansion and contraction of the tubes. Built of the highest grade materials, consisting of pure copper and cast-iron.

**For boiler feed water, gravity and forced circulation heating systems, hot water service for domestic purposes, etc. Catalogue on request.**

**ALBERGER HEATER COMPANY, BUFFALO, N. Y.**

**CHICAGO, ILL.**

*Your Choice of Seven Types*

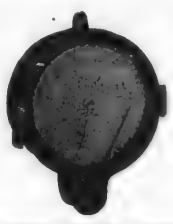
*is offered in our line of*

**Standard Recording Thermometers**

**We make a specialty of hot water and steam indicators**

*Send for Catalogue VH*

**Standard Thermometer Co., Clifton and Shirley Sts., Boston, Mass.**



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# Better Valves

Detroit Packless Radiator Valves were designed to meet the demand for better valves.

They have proved to be better in every way—they are absolutely tight and will stay tight—they do not leak around the stem nor need repacking.

The installation of Detroit Packless Valves means economy and permanent satisfaction for the building owner.

## Detroit Packless Radiator Valves

are being specified in prominent buildings throughout the country because they meet that all-important requirement of maximum utility combined with beauty of line and finish.

The first cost is the whole cost—there is no occasion for having a man spend most of his time keeping them in condition, and there is no danger of their becoming unsightly from rusty, dirty water.

Their lines are substantial, symmetrical and pleasing.

The metal surfaces have a smooth satin finish that will not deteriorate—the handles are mahogany finish, large and nicely proportioned. In fact, Detroit Packless Valves are finished in a manner to harmonize with the most beautiful surroundings.

And the line is complete—angle—corner—globe—gate—in all sizes for every kind of installation on steam and hot water systems.

Illustrated Booklet V-46 gladly sent on request.

***"A Radiator Valve That Can't Leak"***

Equipped with Genuine Detroit Packless Radiator Valves.

**DETROIT LUBRICATOR COMPANY**
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO.

**Makers of the Stewart Carburetor**

EQUITABLE BUILDING, NEW YORK
Architect, Ernest R. Graham
Heating Contractors, Thompson-Starrett Co.

building 30 cents per 1,000 lbs of steam condensation, which is 6 cents lower than the customary charge. The electric company uses King County coal exclusively in generating its heat. A delegation of coal men urged the commissioners to favor this product, as against California oil, which is used by the city under its boilers.

**Des Moines, Ia.**—The action of the city council in submitting a franchise for a central heating plant has been indorsed by the smoke abatement commission of that city, the commission expressing itself to the effect that it would help materially to eliminate the smoke nuisance in the business district.

**Nashwauk, Minn.**—A municipal central heating plant was considered by the local city council recently when a representative of the Crane-Ordway Co., of Duluth, was presented to explain the proposition. The matter came up through the fact that the town has two idle boilers, which might be used in such a plant. These boilers have not been in use for some time, because the town is getting light and power from private sources. The matter was taken under further consideration.

**Seattle, Wash.**—The city council has refused to grant a renewal of the steam heating franchise of the Puget Sound Traction, Light & Power Co., which expired February 19, 1915, until the public service commission rules on the petition of the traction company asking exemptions from certain street railway franchise requirements. The franchise covered the district bounded by Madison and Main Streets and Railroad and Third Avenues. It is expected that the company will heat the county building under a temporary permit.

**Spokane, Wash.**—The Merchants' Central Heating Co., organized by H. A. Flood and associates, to supply the business section of Spokane with steam heat from a central power plant, has filed a mortgage with the Washington Trust Company, as trustee, for $250,000. This method of financing the company is the culmination of the plans on which Mr. Flood has been working ever since he obtained the franchise from the city for this service. A contract has been signed with the American District Steam Co., No. Tonawanda, N. Y., amounting to $50,000 for the installation of the system. The company's plans for its first installation contemplate the improvement of the property which it acquired between Post

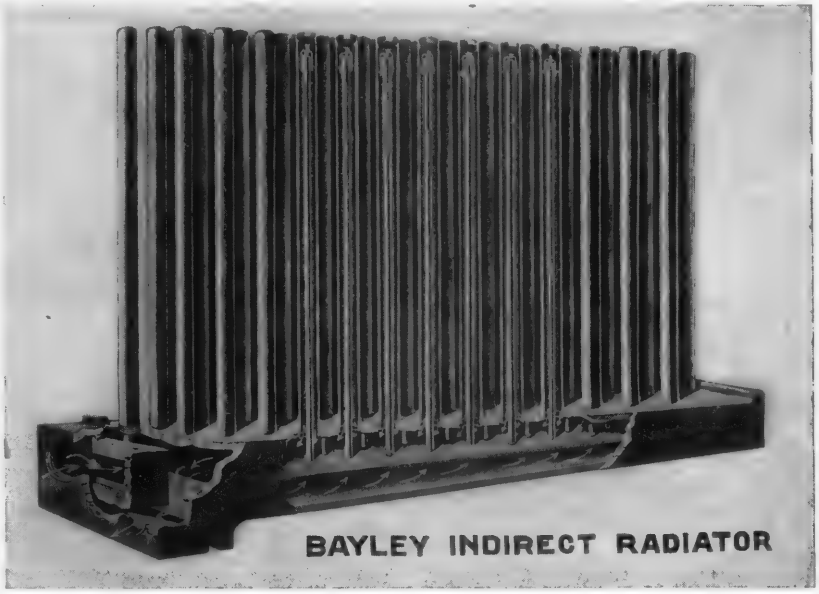
**Bayley new type of Indirect Radiator for heating, ventilating and drying purposes.**

**The construction of this radiator is unique in that there are no elbows, return bends or nipples used.**

Its efficiency is high, as the drainage is perfect, and as it frees itself readily from air, every foot is prime heating surface.

Its tubes are individual and thus free to expand and contract independently of any other pipe.

It is adaptable to almost any space, as it can be placed with pipes in a vertical or horizontal position or any modification of these positions. It requires no double decking (with double steam and drip connections and structural supports) to obtain necessary free area.




**BAYLEY MFG. CO.** MILWAUKEE WISCONSIN

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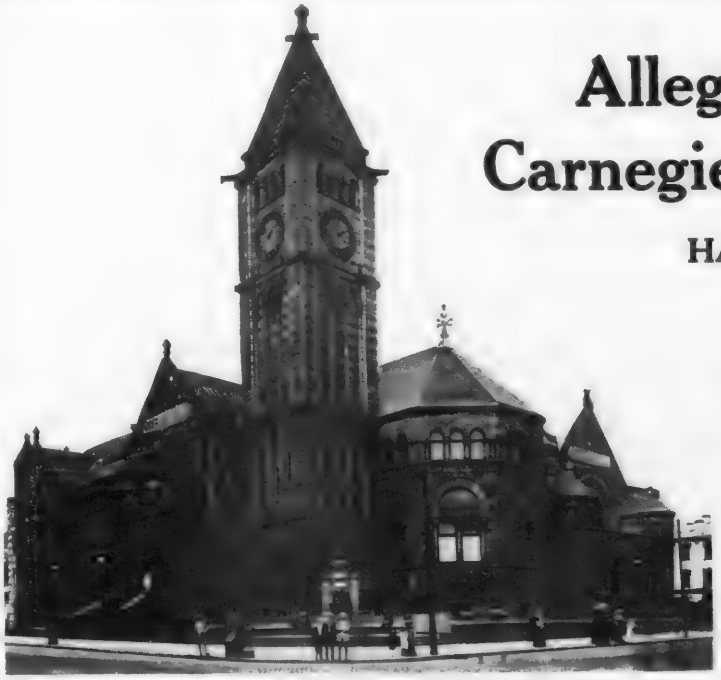


# Allegheny Carnegie Library

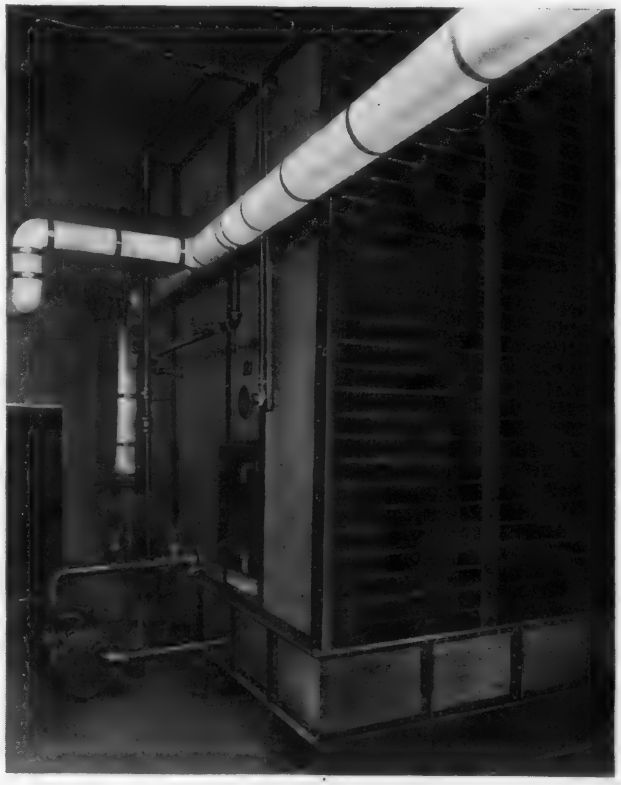
HAS

**Sturtevant** REG. U. S. PAT. OFF.

***Air Washer and Fans***

In the above building, Sturtevant Multivane Fans supply air for library and music hall.

Air Washer is a Sturtevant 7 x 9 Type H with atomizing type nozzles and with capacity of 28,000 cu. ft. per minute—Washer fitted with window and marine electric light—also with float valve to automatically regulate height of water in tank—Constructed of galvanized ingot iron with all parts exposed to the water heavily coated with bitumastic enamel.



Our Air Washer Department will cooperate with you in all humidifying or air conditioning work.

## B. F. Sturtevant Company

HYDE PARK, BOSTON
MASSACHUSETTS

And All Principal Cities of the World

and Lincoln Streets, where a boiler house will be built. The engineer's reports contemplate an ultimate expenditure of $625,000 in the installation of power house and steam mains. The first or initial financing and installation, it is stated, will require an expenditure of about $233,000.

It is contemplated eventually to supply at least 35 blocks between the river on the north, the Northern Pacific tracks on the south, Bernard Street on the east and Monroe Street on the west. Among the buildings which have already arranged to take the heating service are the Hyde, Eagle, Wolverton, Empire State, Temple Court, Old National, Peyton and Marble Bank building.

The Merchants' Company has appointed E. Darrow as manager. Mr. Darrow was until recently general manager of the Merchants' Heat & Light Co., of Indianapolis, Ind., which is one of the largest central heating systems in the United States. Mr. Darrow is also one of the vice-presidents of the National District Heating Association.

Among the other buildings which may be supplied by the Merchants' company's plant is the city hall in Spokane. The present cost of heating this building is $4,450 a year, which includes $2,500 worth of coal, two engineers, one at $90 a month and one at $85, and about $100 a year for the disposal of ashes. It is estimated that the use of central station heat would effect a saving of from $400 to $500 a year.

In addition to the president of the Merchants' company, Mr. Flood, the other officers are: Vice-president, R. J. Danson; secretary and treasurer, H. B. Ferris.

### Manufacturers' Notes.

**Clarage Fan Co.,** Kalamazoo, Mich., has appointed N. L. Alison manager of its eastern branch, at 149 Broadway, New York. Mr. Alison was until recently chief engineer for the Utah Engineering & Machinery Co., Salt Lake City, Utah, and had direct charge of the installation of the electric heating plant for the Burley High School, Burley, Idaho, described in this issue.

**Central Foundry Co.,** New York, held its sixth annual dinner at the Hotel Knickerbocker, in New York, December 4. Covers were laid for 64, the company including President Waddill Catchings, Vice-President de Courcey Cleveland, Second Vice-President C. C. Todd and Secretary R. R. Rust.

**Bishop-Babcock-Becker Co.,** Cleveland, O., announces the election of the following directors at the annual meeting of the com-

DIRECT CONNECTED BLOWER WITH HEATING COILS—NEW YORK EDISON BLDG. ARCHITECTS, GRAHAM, BURNHAM & CO.

ILG

UNIVERSAL BLOWERS WILL PLEASE YOU

They are easy to install
They take up little room
They run without vibration

SALES OFFICES IN

CHICAGO NEW YORK
PHILADELPHIA CLEVELAND
PITTSBURGH ST. LOUIS DETROIT

Ilg Electric Ventilating Co.
[158 WHITING ST., CHICAGO

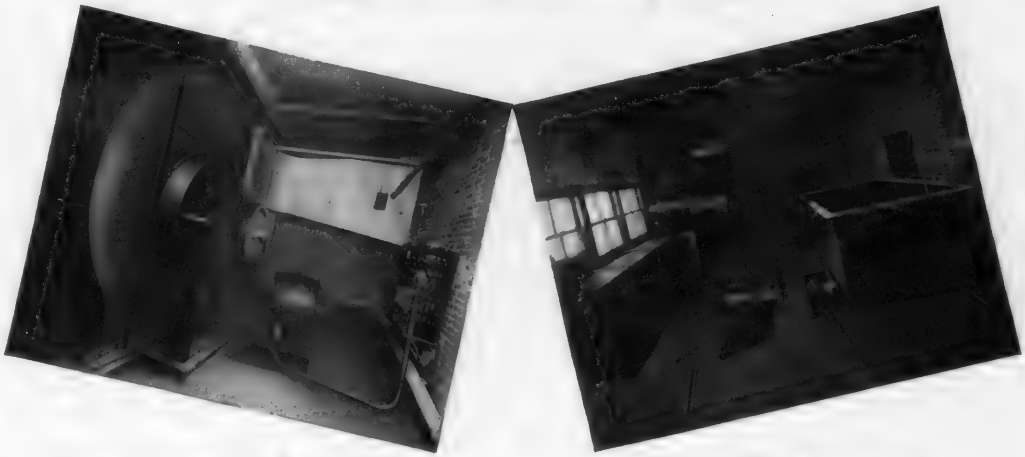
SPRINGFIELD HIGH SCHOOL OF COMMERCE, SPRINGFIELD, MASS.
Architects, Kirkham & Parlett Engineers, Richard D. Kimball Co.

# 15 Sturtevant Fans
(REG. U. S. PAT. OFF.)
# in New High School

In the new school just erected in Springfield there are 15 Sturtevant Fans, all driven by Sturtevant Direct Current Motors. The units are as follows: Supply Apparatus—two No. 13 Multivane Blowers, 58,000 CFM, chain drive—one No. 12 Multivane Blower, 25,000 CFM, belted—Exhaust Apparatus—two No. 12 Multivane Fans, 50,000 CFM, chain drive—one No. 12 Multivane Exhauster, belted, 60,000 CFM—two No. 9 Multivane Exhausters, 12,000 CFM, belted—one No. 4 Multivane Exhauster, direct connected 8,000 CFM—Two size D Ready-to-Run Ventilating Sets also installed for exhaust.

The vast amount of business obtained by the Sturtevant Company is due to service rendered. The apparatus is right and the company stands back of it. Let us be of service to you.

## B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASSACHUSETTS
AND ALL PRINCIPAL CITIES OF THE WORLD



SUPPLY APPARATUS IN BASEMENT EXHAUST APPARATUS

pany's stockholders: E. S. Griffiths, Carl C. Harris, Joseph H. Champ, W. B. Prince, L. A. Becker, E. H. Weatherhead, Robert F. Mackenzie, Frank Rosenweig and Howard Yeomans. The new directors elected the following officers: President, E. S. Griffiths; vice-president, Carl C. Harris; treasurer, Joseph H. Champ; secretary, E. T. Sargent.

**Hart & Crouse Co.,** Utica, N. Y., has appointed William M. Kingsbury manager of the company's new blast radiator department. Mr. Kingsbury, who for the past 13 years has been heating and ventilating engineer in the Department of Education in Cleveland, is the inventor of the hot blast radiator, which is now being marketed by the Hart & Crouse Co. He will continue to make his headquarters in Cleveland. The company also announces that M. L. Foote, formerly with the Iroquois Engineering Co., of Chicago, is now representing the Hart & Crouse Co. in Michigan, Ohio and Indiana.

**Youngstown Sheet & Tube Co.,** Youngstown, O., according to reports, is conducting negotiations for a proposed merger with the Lackawanna Steel Co., Lackawanna, N. Y., and the Cambria Steel Co., of Johnstown, Pa. In this connection plans are being made for an early extension of American iron and steel trade in foreign countries.

**W. A. Case & Son Mfg. Co.,** Buffalo, N. Y., dealers in heating and plumbing supplies, has taken over the supply business of the R. C. McClure Co., of Syracuse. The house at Syracuse will be continued as a branch of the Case company.

**Merchant & Evans Co.,** Philadelphia, Pa., has removed its principal offices and city warehouses from 517 Arch Street to 2019-2035 Washington Avenue, Philadelphia.

**Symonds Register Co.,** St. Louis Mo., has moved into its new factory at 3117-3123 Minnesota Avenue. The company's new plant occupies a site 100x125 feet. It is stated that the company's present line of registers will be supplemented by a number of new products.

**Howard Thermostat Co.,** Oswego, N. Y., has been reorganized with the following officers: President, A. P. Murdock; treasurer, George E. Farrell; vice-president and secretary, John F. Otis.

### New Firms and Business Changes.

**Donohue & Creech,** Marengo, Ia., composed of J. J. Donohue and J. W. Creech,

JSC
One-Half the Size—
Double the Desirability.
More sensitive thermostatic control in the neat, inconspicuous Johnson Thermostat, which is less than half the size commonly in use—that is what you get in the new Johnson model thermostat. It is only two inches wide and less than five inches long—is responsive to slightest change in temperature, and is not affected by atmospheric pressure—has "open and closed" heat indicator, positive shut off, heat locking device, patented adjusting dial, and self-adjusting regulator.
Johnson Service Co.
Milwaukee, Wis.
Branch offices and service stations in all principal cities.

# "Sirocco"

## *Good Materials—Good Design—Good Construction and Good Results*

A combination which makes for permanent satisfaction.

Such prominent Engineering accomplishments as the Hudson Tubes — Pennsylvania Railroad Tunnel — Brooklyn Bridge Station—New York Terminal Station—Equitable Building—and many others in which our apparatus is installed is indicative of the confidence placed in our goods by the Engineering profession.

## "Sirocco" Fans have These Good Qualities

The Ford Motor Co.—the Packard Motor Co.—Toledo Factories Building of Toledo, Ohio—the Baker-Vawter Co., of Benton Harbor were convinced that "Sirocco" had the merits claimed for it and installed it in their industrial and office buildings.

The user displays confidence in "Sirocco" by installing and the Engineer displays confidence in "Sirocco" by advocating it—that's what has made "Sirocco" such a success.

An Engineer's binder of bulletins on "Sirocco" and "ABC" Products will be mailed at your request—they're standard size—Ask for Engineer's series No. 2509.

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN. U S.A.

Canadian Sirocco Co., Limited, Windsor, Ont., Manufacturers for Canada.

The illustration shows a "Sirocco" Induced Draft Installation at the plant of the Farnum Cheshire Co., Farnum, Mass. Two No. 6 American "Sirocco" Fans.

has purchased the Lamprecht Plumbing and Heating Co., of that place, and will continue the business under the new name.

**Rogers-Ebert Co.,** East Orange, N. J., is the name of a new heating and plumbing supply house, which has taken quarters at 593 Main Street. President, James Rogers; treasurer, Frank A. Ebert, formerly connected with the Orange Supply Co. Other members of the company are: Thomas A. Clareson, secretary; and J. F. Rogers.

**Willimantic, Conn.**—Minot S. Fryer has purchased the heating and plumbing business formerly conducted by the late F. W. Gerrick and will consolidate it with his own business in the same line.

**Lingley & Holway,** Boston, Mass., is the title of a new heating contracting firm which has opened quarters at 14 Medford Street. Both members of the firm were formerly connected with H. B. Sanborn.

### Business Troubles.

**Farley Heating & Plumbing Co.,** Kansas City, Mo., has failed, with liabilities at $15,656 and assets at $12,821.

### New Incorporations.

**Co-Operative Plumbing & Heating Co.,** Birmingham, Ala., capital, $2,000. President, J. N. Martin; vice-president, T. W. Hall; treasurer and secretary, C. E. Cole.

**Becker-Osherowsky Plumbing & Supply Co.,** Cleveland, O., capital $10,000. Samuel Becker is one of the principals of the company.

**William George & Co.,** Syracuse, N. Y., capital $10,000, to take over the heating and plumbing business of the same name. Incorporators: C. E. Cooney, Romeyn Wormuth and D. F. Costello.

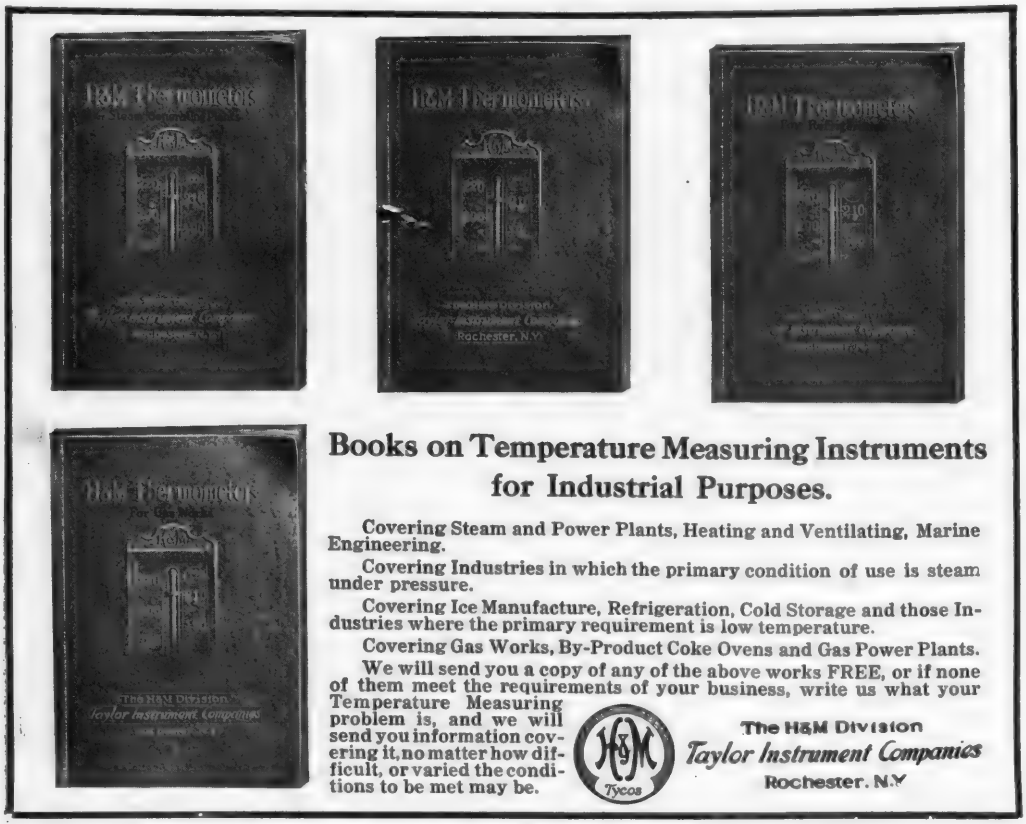
**Central Oregon Plumbing & Heating Co.,** Bend, Ore., incorporated to conduct a contracting business.

**Safety Heater Co.,** Cleveland, O., capital $1,000. Incorporators: William Gilchrist, John D. Gilchrist, H. C. Dorville, J. A. Gilchrist and R. W. Daykin.

**Kerosene Power & Heating Co.,** Buffalo, N. Y., capital $75,000, to deal in petroleum and its products, appliances for generating heat and power from same. Incorporators: A. W. Swanberg, W. J. Eckert, M. D Johnson, 510 Iroquois Building, Buffalo.

**Auto Exhaust Heater Co.,** Grand Rapids, Mich., incorporated to manufacture a device for heating automobiles. Incorporators: Don McAfee, Frank Mathison, Frank Veit, Tunis Johnson and Neil Kunst.

**Des Moines Industrial Co.,** Des Moines,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The H&M Division
Taylor Instrument Companies
Books on Temperature Measuring Instruments for Industrial Purposes.
Covering Steam and Power Plants, Heating and Ventilating, Marine Engineering.
Covering Industries in which the primary condition of use is steam under pressure.
Covering Ice Manufacture, Refrigeration, Cold Storage and those Industries where the primary requirement is low temperature.
Covering Gas Works, By-Product Coke Ovens and Gas Power Plants.
We will send you a copy of any of the above works FREE, or if none of them meet the requirements of your business, write us what your Temperature Measuring problem is, and we will send you information covering it, no matter how difficult, or varied the conditions to be met may be.
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Rochester, N.Y.

JOHNS-MANVILLE SERVICE

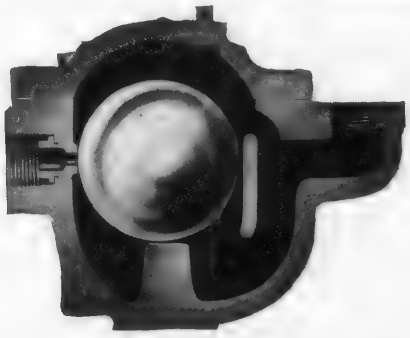
JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

OUR interest in a J-M Product does not stop with the sale. Every J-M Product is backed by the resources of a nation-wide organization with over half a century's reputation for Quality and Honorable Dealing and is sold plus the assurance of a reliable service now in actual operation in every important city of North America. This service makes the J-M Guarantee of Satisfaction an actuality wherever you may be.

# Install the J-M Steam Trap and forget it

***—it needs no attention.***



There's no fussing, no fixing, no adjustments, no repairs, necessary with the J-M Steam Trap. The only moving part is a ball unencumbered by rod or lever. The ball closes the discharge orifice until the excess water in trap rolls it upward—and out goes the water. Out goes the air, too. THE J-M TRAP CAN'T GET AIR BOUND because the air forming a film on the surface of the water is forced out with it.

**"A Ball—that's All"**

That's the secret of J-M Steam Trap efficiency—its simplicity. Not even a by-pass connection is necessary. The little J-M Junior Steam Trap for small units is fitted with a seat in its inlet which makes it a check valve and trap combined. The J-M Steam Trap solves the problem of getting rid of condensate and air and solves it for good. Get the J-M Steam Trap Bulletin.

## H. W. JOHNS-MANVILLE COMPANY

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| Akron | Boston | Columbus | Duluth | Kansas City | Minneapolis | Philadelphia | St. Paul | Toledo |
| Albany | Buffalo | Dallas | Galveston | Los Angeles | Newark | Pittsburgh | Salt Lake City | Washington |
| Atlanta | Chicago | Dayton | Houghton | Louisville | New Orleans | Portland | San Francisco | Wilkes-Barre |
| Baltimore | Cincinnati | Denver | Houston | Memphis | New York | Rochester | Seattle | Youngstown |
| Birmingham | Cleveland | Detroit | Indianapolis | Milwaukee | Omaha | St. Louis | Syracuse | |

The Canadian H. W. Johns-Manville Co., Ltd., Toronto, Winnipeg, Montreal, Vancouver 590

Ia., capital $200,000, authorized to sell heat, power, light and to manufacture beverages. President, Gustav Tegeler; vice-president, Joseph Muelhaupt; secretary F. P. Mattes.

**Ivor Heater Co.,** Kalamazoo, Mich., capital $10,000, to manufacture gas and electrical heaters, novelties and appliances. Incorporators: Dwight C. Jewett, Agnes E. Grace and Dr. J. E. Kilgore, all of Kalamazoo. The principal device to be made by the company is a gas heater which does not dehydrate the air. Use is made of a blue flame, and it is claimed that little oxygen is used, while the moisture removed is rapidly replaced by means of a device which is a part of the heater.

**Standard Rotary Valve Co.,** Pittsfield, Mass., to manufacture heating specialties. President, J H. D. Beaucage; treasurer, Earl C. Jacobs; secretary, S. Smith.

**Nelson Blower & Furnace Co.,** Boston, Mass., incorporated to manufacture heating and ventilating systems. President, A. H. Nelson; treasurer, William R. Marshall; secretary, F. Batchelder.

**I. R. Goldberg Plumbing Supply Co.,** St. Louis, Mo., capital $10,000 to deal in heating and plumbing supplies. Incorporators: I. R. Goldberg, Mrs. Lena Goldberg and Solomon Thaler.

**Harry G. Kraus, Inc.,** East Orange, N. J., capital $25,000, to conduct a heating and plumbing business.

**R. F. Mason Co.,** Providence, R. I., capital $50,000, to conduct a general boiler and furnace business. Incorporators Rudolph F. Mason, Mabel L. Miller and Charles H. McKenna.

**John E. Weit Co.,** New York, capital $5,000, to conduct a heating and plumbing business. Incorporators: Harold E. Manbinger, Mathilda Meon and John E. Weit, all of 885 Stebbins Avenue.

**Spitz Plumbing Co.,** Cleveland, O., capital $10,000, to conduct a heating and plumbing contracting business.

### Contracts Awarded.

**George M. McGeary & Son,** St. Paul, Minn., heating and ventilating State Historical Society Building, in St. Paul, for $40,324. The building complete will cost $500,000.

**Siebert Co.,** San Francisco, Cal., was the low bidder at $3,401, for the heating and ventilation of the Redding School (18 rooms). For an alternate proposition (12 rooms), Scott Co. was low, with a bid of $3,220.

**Pacific Blower & Heating Co.,** San Francisco, Cal., heating and ventilating new $40,-


# We Propose

THAT YOU SPECIFY

SYRACUSE PACKLESS VALVES

FOR 1916

*and live a peaceful happy life ever after*

SYRACUSE FAUCET AND VALVE COMPANY

Office and Factory
Syracuse, N. Y.

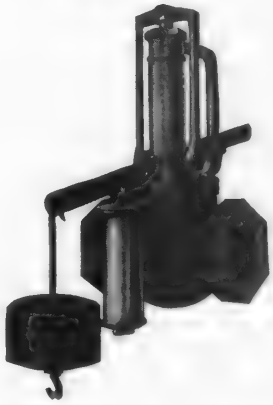
Sweet's Catalogue Page 1094
GEO. A. WELD CO., 79 Milk Street, Boston

220-224 West 42nd St.
New York City

# DAVIS VALVES

*for the*

## Automatic Regulation of Pressure



Automatic Valve Specialties play an important part in the operation of most every high pressure steam plant. They are installed to perform certain functions and their failure quite often means interruptions, delays and expense.

For nearly forty years Davis Valves have been held in high esteem by men of experience who specify, install and use valve specialties.

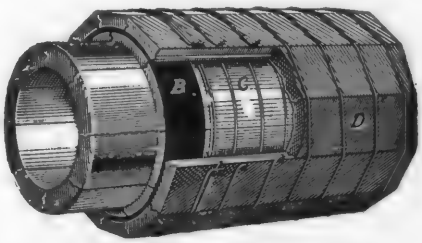
We make—

**Pressure Regulators**
**Balanced Valve**
**Float Valve**
**Steam Trap**
**Back Pressure Valve**
**Exhaust Relief Valves**
**Stop and Check Valves**
**Pump Governor**
**Condensation Receiver**
**Damper Regulator**
**Vacuum Pump Governor**
**Radiator Air Valves**

When you are again in the market, try Davis Valves. Their efficiency will please you.

## G. M. Davis Regulator Company

***436 Milwaukee Ave., Chicago***

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000 grammar school building at Suisun, Cal., for $3,987.

**Allen-Scales Engineering Co.,** Nashville, Tenn., was the low bidder for the heating and ventilating of the Elliott and Pearl Schools, in that city, the bids being $6,797 and $8,093, respectively. The low bidder for the plumbing was the East Side Plumbing Co., whose estimates were $5,927 and $5,041, respectively. The Allen-Scales Co. has the contract for heating and ventilating the Clemens Grammar School, in Nashville, at its bid of $5,800.

**J. F. Shea,** Portland, Ore., heating and plumbing 4-story Alisky Building, Third and Morrison Streets, for $7,500.

**Waterbury, Conn.**—Bids were received as follows for the heating and ventilating of the Hendricken School: Heating (with air washing), Barlow Bros., $8,700; M. J. Daly, $9,616; Daly Bros, $9,478 (without air washing), Barlow Bros, $8,200; M. J. Daly. $9,106; Daly Bros, $8,976.

**Appling & Griggs,** Tacoma, Wash., heating, ventilating and plumbing the $250,000 St. Mary's Hospital, in Walla Walla.

**P. J. Dowling & Co.,** Spokane, Wash., heating and plumbing the $100,000 monastery of the Poor Clare Sisters, at Mission Avenue and Dakota Streets, for $7,000.

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**Washington, D. C.**—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

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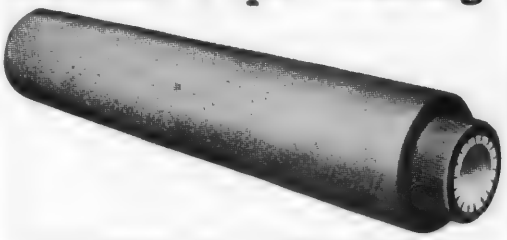

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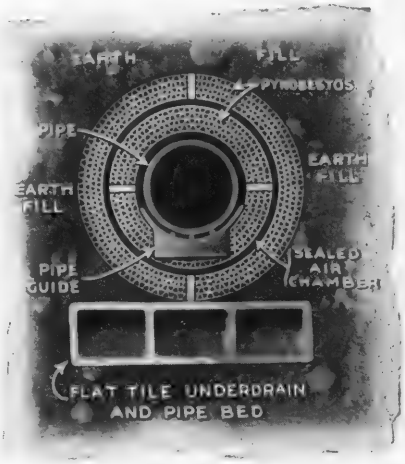


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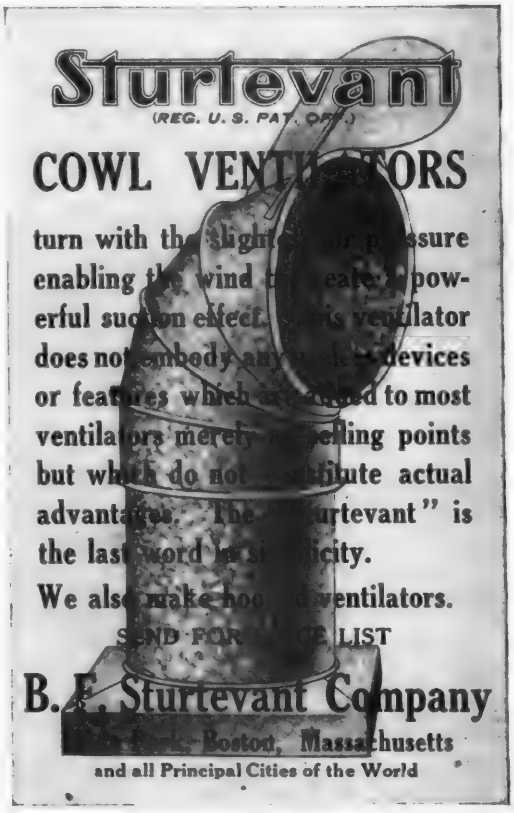
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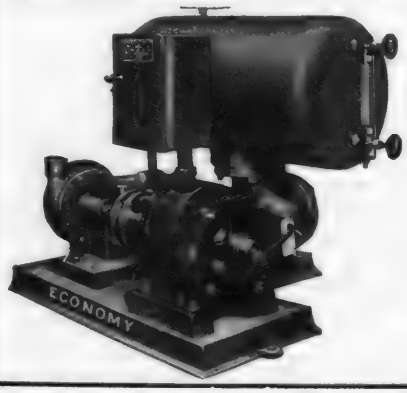


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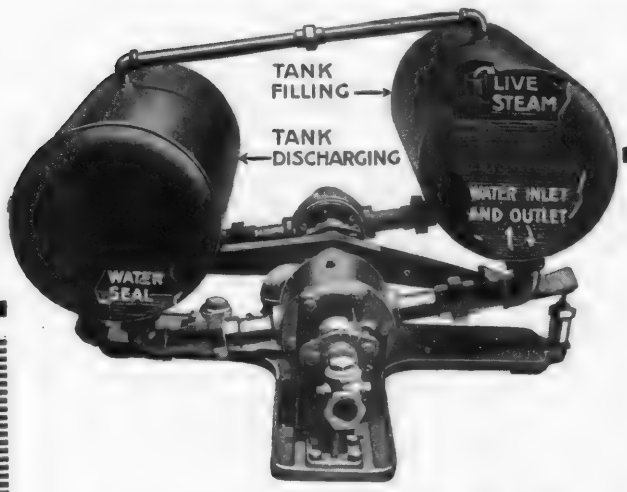


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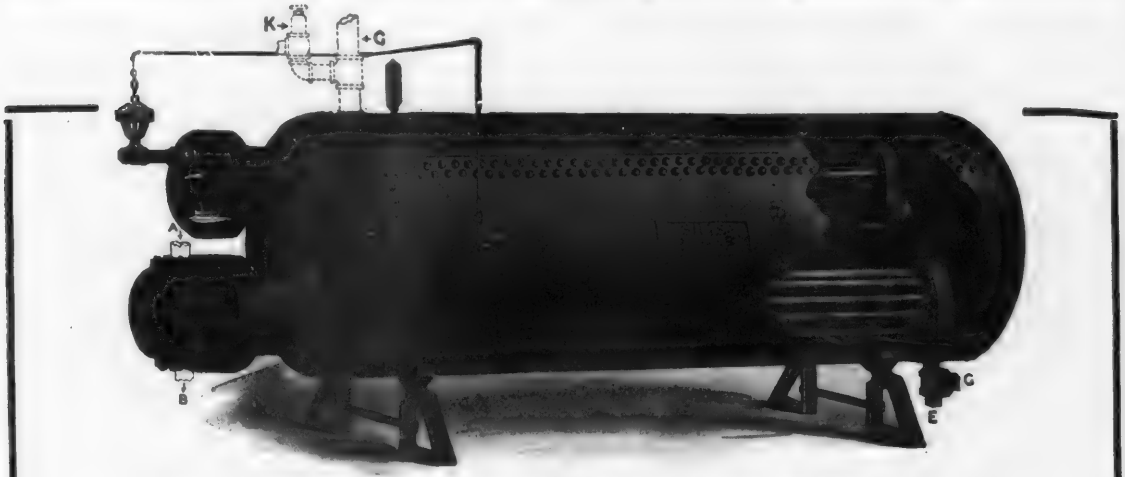


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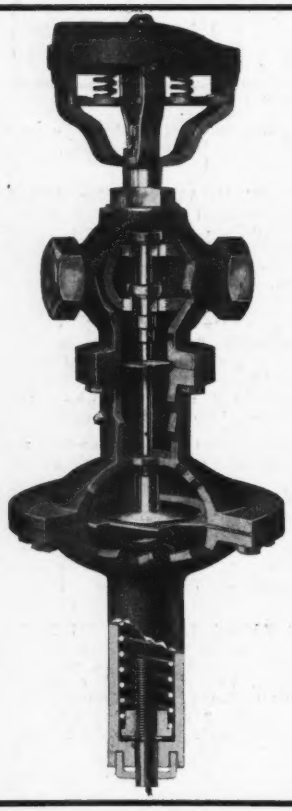

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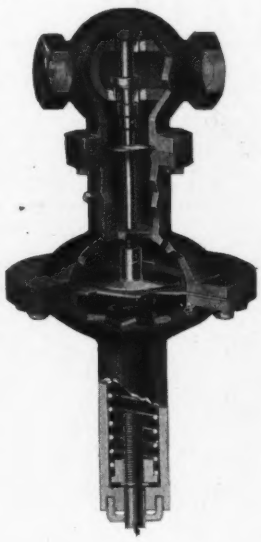

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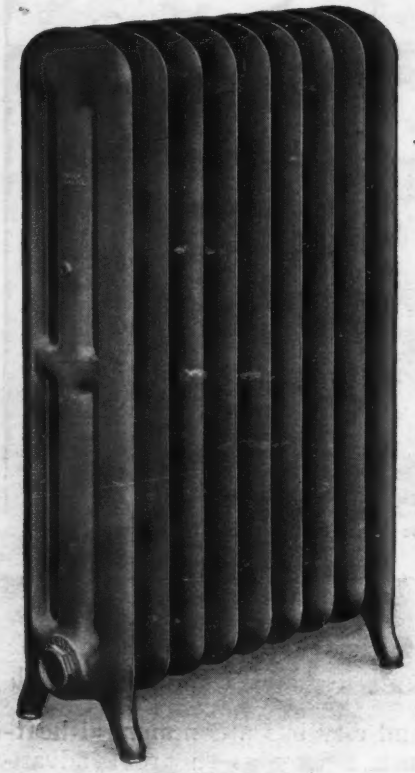

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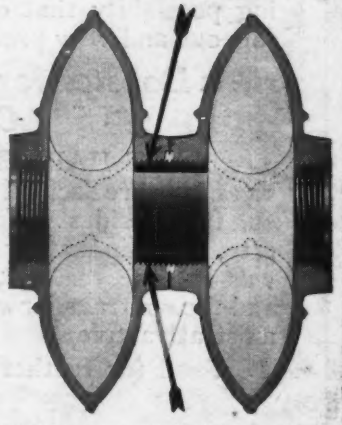

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